ELECTRICAL REVIEW

7th AUGUST, 1953

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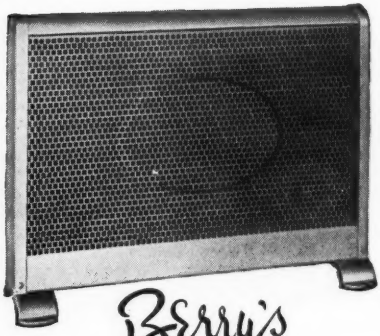

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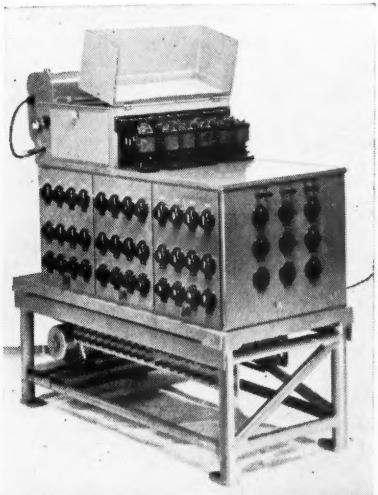

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ELECTRICAL REVIEW

7th AUGUST, 1953

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. 153 • NO. 6

Hydro-Electric Prospects

ALTHOUGH not among the most favoured in the matter of water power, this country has long been concerned through its engineers in putting schemes into service abroad as well as at home. The most promising fields for major future activities lie in less well developed parts of the Dominions and Colonies. The magnitude of these can be only surmised in most cases because of the lack of data from adequate surveys of possible resources, notably those relating to stream flow and atmospheric precipitation at high altitudes. Even with fuller knowledge of theoretical potentials, there would remain the question of the proportions which could be exploited technically and economically. For more immediate purposes rough valuations of the gross amounts would suffice in most cases.

Some guidance in assessing how much of these could be usefully applied is obtainable from a study made by the United Nations Economic Commission for Europe (reviewed in our issue of 26th June). The records, although by no means complete, are probably near enough to actuality to indicate trends that are of practical value. Estimates of the ratio of the greatest technically feasible production of electricity to the gross potential vary widely with local conditions, never exceeding a half and, in worked-out schemes, averaging about a third. On the other hand there is remarkable consistency as regards the economic ratio, which comes out at somewhat less than one-fifth, depending upon hours of utilization among other factors. Initial forecasts of gross potential have generally proved to be unduly conservative (as in Scotland), while improvements in turbine efficiencies and civil engineering methods and the use of larger generating sets have done much to offset the rise in price levels. At the same time the tendency to develop less expensive schemes first will no doubt cause the capital cost per kW of generating plant and longer transmission lines to increase progressively, especially for undertakings which involve considerable

storage to ensure continuity of supply in all seasons. At present comparison is generally with thermal plants but, as total resources diminish, measurements of this kind would seem to have less meaning. A more valid comparison may then be with the cost of doing without electricity altogether or at least with the value of human or animal labour. This ultimate standard is likely to leave a wide enough margin for financing developments for supplying electricity to industries in which the price to be paid for power is not a major component of the value of the finished products.

THE CROSS-CHANNEL PROJECT

Interconnection of the British and French transmission systems promises more than the term "diversity" usually implies. A large proportion of the electricity produced in France comes from water power stations, so that in addition to the material aid that could be given during the differing consumers' peaks, there would be the prospect of a night load for British steam stations in reducing the drain on reservoirs there. In return for kW received at need during the winter here, the current flow could be reversed if spring rains were insufficient to replace water storage. Moreover, the cost of a 100 MW connection at £4·5 million (shared equally) would be substantially less than that of installing an equivalent amount of generating plant.

PLANT POSITION

Only in very severe weather is the national gap between generating plant capacity and demand next winter likely to be more than can be coped with by voltage reductions. This overall estimate, however, does not apply equally to the whole of the country. In certain areas the position is less favourable than elsewhere and power cuts may be necessary unless special arrangements are made for reducing demand; therefore load spreading arrangements are to be left to the discretion of the Regional Boards for Industry. The basis of the forecast is a net increase in plant capacity this year of 1,300 MW and although in the first half of the year only 244 MW has been added, it is normally the case that the bulk of new plant is commissioned in the latter months of the year.

FUEL TECHNOLOGY

The ultimate success of the expanded fuel advisory service initiated by the Ministry of Fuel and Power will, no doubt, depend largely upon the growth of consciousness of the basic importance of not wasting heat. While this mental attitude should permeate all ranks of workers from the management downwards, heat economy is primarily the responsibility of engineers, whose duty it is to apply natural resources efficiently. Automatic response to this requirement needs to be inculcated early in life and the view of Sir Ernest Smith (chairman, Industrial Coal Consumers Council) that fuel technology should form a regular feature of engineering education seems logical.

EARTHING IN MINES

The difficulty of drawing up regulations giving adequate protection against known risks while permitting advantage to be taken of technical progress is illustrated by amendments proposed to Nos. 125 and 130 of the Coal Mines Electricity Regulations of 1913 and 1920. The revisions, published in draft recently, relate to the minimum size of earthing conductors (to be 0·01 sq in) for portable drilling machines supplied at 125 V and less and to the former prohibition of the use of flexible metallic covering alone for earthing purposes. They replace the Defence Regulation which, in 1940, sanctioned the use of certain types of more economical cables which, although not complying with the original statutory requirements, conform to B.S. 708 and have proved to be equally safe.

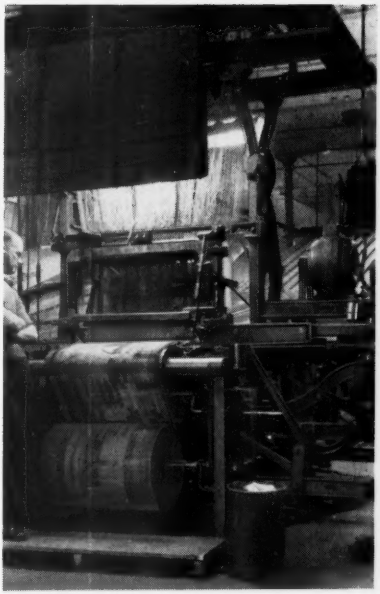
Jute Industries

Manufacture of Carpet and Twine

HAVING in our two previous articles on 29th May and 10th July indicated the uses to which electricity is put in the preparing, spinning and weaving of jute, we shall now complete the picture by showing further applications in carpet and twine making, two important subsidiary activities of Jute Industries, Ltd.

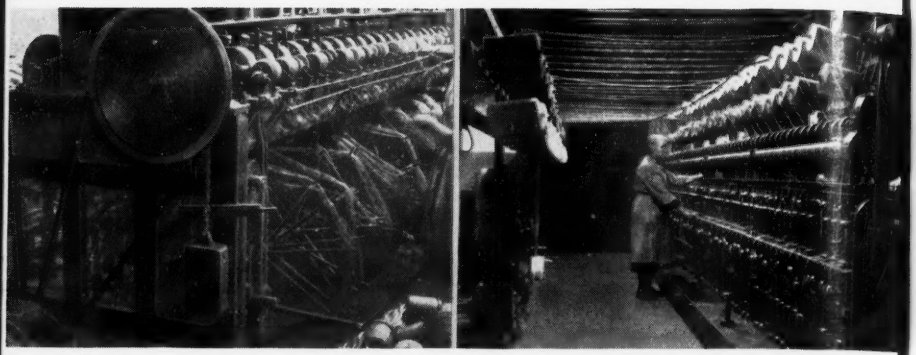
The company's Tay Works produces a wide range of Jacquard woven Wilton carpets, round fur chenille and also imitation tapestry ("Brusselette"). The basic difference between Jacquard weave and chenille is that in the former the pattern is obtained by altering the colour of the warp threads, while in chenille the prefabrication of the weft with the required colours incorporated at the appropriate places produces the desired effect.

The patterns for the Jacquard weave are produced with the aid of punched cards



Jacquard loom driven by a 2 h.p. Brook motor

Yarn for the filler warp of Wilton carpets is starched and dried before use (see below)



Left: **The jute for the warp of Wilton carpets is generally received in hank form and then wound on bobbins.** *Right:* **Machines for twisting the yarn to be used for the warp yarn of the various types of carpets**

which are stitched together electrically ready for feeding into the interpreting device on the loom. Usually chenille patterns are produced by visual means by the machine operator but a mechanical device employing punched cards has also been developed for this process.

The jute employed for carpet making is generally received in hank form for dyeing and is wound on to bobbins by groups of machines driven by 2 h.p. Brook motors. Winding machines are also available for dealing with odd lengths of jute. The yarn for filler warp is passed through a starching and drying machine consisting of a series of heated rollers which are driven by a 14 h.p. Siemens motor.

There are looms of various types installed in the works, some group driven and others individually driven, the latter by 2 h.p. and 2½ h.p. motors. A double Wilton loom direct driven by a 2½ h.p. Brook motor is provided with reversing and inching facilities, magnetic brakes and a number of safety features, including an automatic stopping device which comes into operation when a break occurs in the bottom chain, pile warp or knife bands.

A Wolf grinder is used to sharpen the knives for cutting the warp threads to produce the pile. Fluorescent tubes in "Ediswan" fittings give adequate illumination where most required.

For stiffening the backing of the carpets there is an electrically driven starching machine, comprising pick-up rollers, a steam heated drying chamber and fans for passing the heated air through the carpets. The starch preparation units are also motor driven. After starching, the widths of carpet are stitched together mechanically where required and, in the case of Wilton, cropped, hemmed and fringed.

In the chenille carpets the pattern in

Wilton carpets are mechanically cropped

the weft is built up by small tufts of the desired colour. These are produced in strip form and then cut lengthwise, a fur cutting machine giving the required pile effect.

Most of the chenille weft looms are belt driven by one 25 h.p. Mather & Platt motor, but new machines being installed have individual drives. A feature of these machines is the double shuttles, one of which carries the weft and the other a thread for binding it in position. Machines are also available for twisting threads of different colours together for forming warp.

Printing is another device used in the imitation tapestry carpets to produce a pattern. The machines installed are capable of printing up to four colours to a width of 27in or a single colour up to 2yd.

In the dyehouse, which prepares the jute for carpet making, stainless steel dyeing machines, each taking from 2 to 5 cwt of yarn at a time, have now replaced the old type of wooden vat. These new machines are electrically agitated and the flow cycle, temperatures and pressures are automatically controlled by Drayton regulator equipment, with Igranic timing devices controlling liquor circulation. A " Timonitor " signalling device (English Clock Systems) in the manager's office keeps a check on the timing, giving further assistance in gauging the effectiveness of the dyeing operation. Marconi pH meters are also used for dye bath control.

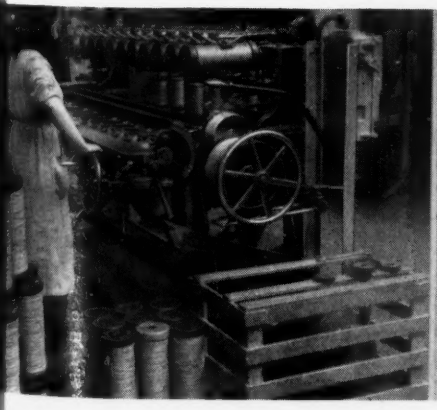
Morris 2-ton hoists, fed from conductor rails, are used for leading the yarn in and out of the vats and hydro-extractors from which it passes to two steam heated drying machines, driven by 20 h.p. and 25 h.p. motors respectively. A bucket type elevator takes the yarn to the material stores.

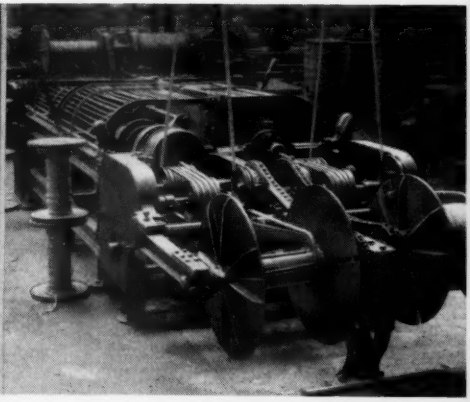
The exceptionally lofty construction adopted for the dyehouse obviated the necessity for fume extraction plant, but it created lighting difficulties. These have been successfully overcome by the use of eight " Ediswan " 400 W mercury vapour lamps, which are found to give a considerably better light than twelve tungsten lamps previously tried. The risk of damage to the electrical installation by fumes is avoided by the use of Pyrotenax mineral insulated cables throughout.

Twine and rope making is carried out at the company's Bowbridge Works. Here the yarn is twisted into the desired number of plies (from 2 to 33) by high speed machines driven by 25 h.p. or 37½ h.p. motors. Where a polished finish is required starch is applied and the yarn is passed over heated metal cylinders.

The twine is then wound into balls or on to spools, or cut into specified lengths. The balls are supplied in sizes ranging from 1 oz to 14 lb in weight and spools are available containing from 1 oz to 30 lb. A group of strand-forming and rope-making machines driven by 15 h.p. and 25 h.p. motors produce ropes and cords from ⅜in to

Left: **The smaller balls of twine are wound on semi-automatic machines, twelve at a time, in 2½ minutes.** *Right:* **A twisting machine group driven by a 25 h.p. motor produces ropes from ⅜in to 2¼in in circumference**





2½in circumference. A new fluorescent lighting system utilizing " Ediswan " fittings has been installed in the balling room and is to be extended to other departments.

For assistance in the preparation of this and the previous two articles in the series, we thank Mr. James Strachan, a director of Jute Industries; Mr. W. H. Shepherd, the company's chief electrical engineer; and Mr. P. Philip, Dundee area manager, and Mr. J. I. Moir, district engineer, North of Scotland Hydro-Electric Board.

Demand and Supply

Improved Electricity Position

THE Electricity Sub-Committee of the Joint Consultative Committee, in its report published last week (H.M. Stationery Office, price 4d) reviews the prospects for the coming winter. As already announced by the Minister of Labour (Sir Walter Monckton), no formal national load spreading target is proposed, any arrangements of this character being left to the discretion of Regional Boards for Industry in the light of conditions likely to arise in their areas. All possible encouragement is again to be given to the use of private generating plant as a means of reducing the load.

The Sub-Committee, of which Mr. H. G. Gee (Ministry of Labour and National Service) is chairman, includes among its members Sir John Hacking, Mr. D. P. Sayers and Mr. P. J. Squire (British Electricity Authority) and Mr. C. T. Melling (Eastern Electricity Board).

This year, as before, the B.E.A. presented a full report of the experience during the previous winter and the prospective position in the coming winter. It estimated the total potential winter peak demand of all consumers at 15,300 MW in average weather, 15,900 MW in average cold weather, and 16,600 MW in weather of extreme severity. These figures take into account so far as practicable general economic trends and other relevant factors and assume that there will be no serious decline in the normal annual growth of demand. The maximum output capacity at the disposal of the B.E.A. is expected to increase this year by some 1,300 MW, after taking into account plant reductions due to removals and de-rating. At mid-December the capacity is expected to be in the region of 14,500 MW, so that the gap between supply and demand at the week of maximum risk in December is likely to be 800 MW (average weather), 1,400 MW (average cold weather) or 2,100 MW (extremely cold weather). These figures, the Sub-Committee points out, show a material improvement on the position in 1952–53 when, without load spreading, it is estimated that the deficit under corresponding conditions would have been 1,100, 1,700 or 2,400 MW.

It is considered, on the basis of these figures, that there should be sufficient plant capacity available nationally to avoid disconnection of supplies in average cold weather, although voltage reduction will still be necessary. In extremely cold weather, however, some 400 MW of load may have to be shed after allowing for the maximum practical voltage reductions. These estimates, it is stressed, are for overall national conditions. In practice, the position varies considerably between different areas, being least favourable in the Glasgow, Birmingham and Bristol Grid Control Areas. After full use has been made of the available transmission capacity and voltage has been reduced, deficits of 2–3 per cent are likely in these areas in average cold spell weather. Disconnection of supplies will therefore be necessary unless special arrangements are made for reducing the demand.

The Sub-Committee records its appreciation of the work of the Area Peak Economy Committees set up by the Ministry of Fuel and Power to secure peak load economy from domestic and the smaller commercial consumers. In view of the improved position it should not be necessary to call upon their services unless the weather is exceptionally severe. Instead, a general appeal to the public for economy at peak hours is recommended.

VIEWS on the NEWS

By REFLECTOR

A STORY with an obvious moral is told in the *Hexham Courant*. Housewives in the mining village of Halton Lea Gate were in difficulties with their modern coal-burning ovens, so the local council invited a demonstrator to show them how to make the best use of them. With thin pastry the results were excellent, but when a rhubarb tart—a favourite delicacy with the miners—was baked the golden brown top was found to cover a " mess of uncooked rhubarb and pastry." The demonstrator, momentarily at a loss, then noticed an electric cooker in the kitchen. " I've got it," she said, " If you can't get the bottom of your cakes baked in your coal ovens, just brown the tops and finish them off in the electric ovens."

* * *

The *West Cumberland News*, commenting on the increased " allowance " for rural electrification, looks forward to the time when

> " even Borrowdale . . . may be supplied with electricity, but not, we assume, without the ' Protection ' societies shoving their oars in again, probably to demand that honeysuckle be trained to climb and cover poles which have to be erected. . . . The thought of washing machines and ' unit ' kitchens in the stone-built homes of Borrowdale may sicken ' Friends ' of the Lake District, but it must bring joy and hope to the hearts of the women of the valley."

This is another example of the bitterness engendered by the apparently irreconcilable claims of beauty and utility. My sympathies are with both parties, for compromise is not always easy.

* * *

An unusual method of debt collecting was mentioned during a recent police court case at Stockport when a man was charged with stealing 19s from an electricity meter. The defendant owed the North Western Electricity Board £8, and being unable to pay, asked the Board to install a shilling-in-the-slot meter. This was done and the meter was so adjusted that the defendant obtained twopennyworth of electricity for each shilling he inserted. By this means he paid off the debt but the Board incurred the magistrate's disapproval of what he called its too-harsh terms. It was explained by the Board that this was an agreed alternative to cutting off the supply.

* * *

I don't know that I approve of the growing practice by manufacturers of so fixing their list prices that, with the purchase tax added, the totals come to nice round figures. Admittedly, it is more convenient to be able to quote, say, a refrigerator as costing £67 10s (£47 17s 5d plus £19 12s 7d P.T.) rather than, maybe, £67 10s 2d (£47 17s 6d plus £19 12s 8d P.T.). The very fact of having an odd amount to pay automatically draws attention to the inclusion of purchase tax, and tends to make the public less likely to accept this objectionable and unfairly discriminative method of taxation as being a permanent and inevitable institution.

* * *

Television viewers who saw the " Science Review " programme last Friday must, I am sure, have been impressed by the demonstration of what ultrasonics can do. In the telefilm, recently made at the Mullard Research Laboratories by Norman Macqueen, ultrasonic waves produced by an electronic oscillator were used to clean marking ink from a fabric, light a cigarette and drill through glass. Another of the diverse applications of ultrasonics, we were told, was to accelerate the maturing of wines and whisky, though on this the commentator observed that there were " varied opinions about the results."

Direct-on-Line Starting

With Special Reference to 3.3 kV Motors

By E. C. SLATER

SINCE the introduction of the national grid system it has become customary to adopt direct-on-line starting for motors wherever practicable. It is proposed to make some observations on problems associated with their use in heavy industrial establishments and power stations, and for this purpose five main factors are taken into consideration: power supply, switchgear, protection, control and the motor.

Power Supply

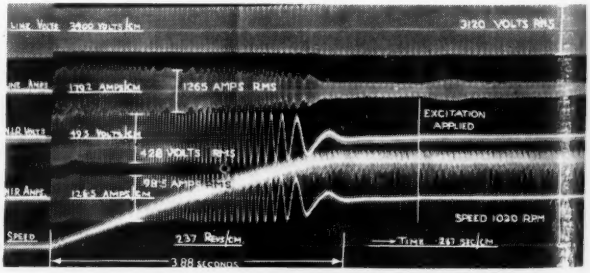
In small works it is convenient to run motors driving pumps, compressors, fans, motor-generator sets and similar service units from the 415 V supply, but in larger works where there is a demand for more and higher capacity drives, the current at this voltage becomes excessive, and as a result a higher voltage is necessary.

Thus 3·3 kV has been generally adopted, and it is now standard practice for most large industrial and power station installations to design all motors of 100 h.p. or over for this voltage. By operating as many as possible of these motors on the 3·3 kV system the current and short circuit power on the low voltage system supplying smaller motors and lighting loads is reduced and the economic advantages are increased.

Motor starting conditions must be closely related to the capacity of the system and should not create undue disturbance to other plant and equipment during starting periods. Lighting installations are most sensitive to variations in voltage, and mains voltage mercury discharge lamps, for instance, will be extinguished if the line drop exceeds 30 V.

An accompanying illustration shows an oscillograph record of the direct-on-line starting of a 2,000 h.p. 3·3 kV synchronous motor driving a motor-generator set. As works lighting supplies are derived from the same 11 kV busbars via different transformers, it was calculated from the oscillograph that during the starting period the voltage at the 415 V busbars was reduced momentarily by about 10 per cent. This allows too small a margin with which to ensure the continuity of the mercury discharge lamp installation and, in addition, badly affects tungsten filament lamps by causing pronounced " dips."

The current transformer ratios of feeder circuits for supplying motor switchboards require special consideration. They must be designed to deal with the starting currents of the largest motor, which may be equal to eight times motor full load, in addition to the normal busbar load. Where there is no means of control to prevent two or more motors starting simultaneously, it will be necessary to allow for this condition when designing the protective circuit. Current transformers with a higher ratio than is normal for feeder protection must be used, bearing in mind the necessity for



Oscillograph record of direct starting of 2,000 h.p. synchronous driving motor of the nine-unit m.g. set shown on the right

TABLE I

Unit	Rating, MVA	Space required, cu ft	Relative cost	
			Supplied by manufacturer	Installed
Oil circuit breaker	75	113	100%	104%
Oil circuit breaker	150	128	136%	141%
Air circuit breaker	150	194	184%	192%
Contactor with h.r.c. back-up fuses	150	509	141%	161%

grading the associated protective relays with adjacent relays on the system in order to secure satisfactory discrimination under fault conditions.

Switchgear

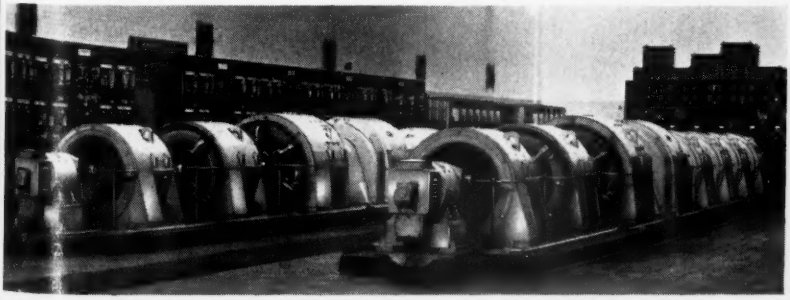
The choice is usually made after due consideration has been given to the duty cycle of the motor. It is common to control a group of such motors from a switchgear installation consisting of circuit breakers which will also act as motor starters by their being remotely controlled from switches situated near the motor. The following types of switchgear are available for this purpose: oil circuit breakers, air circuit breakers and contactors with suitable back-up protection. Air blast switchgear has not been considered because 350 MVA at 11 kV is the lowest rating available at present, and it is ruled out on the basis of cost.

Table I shows approximate relative costs of typical switchboards consisting of the same number of 400 A units employed for 3·3 kV group motor control.

The table also shows how the cost of buildings for switchgear is influenced by the size of the equipment, and this is a factor which must be seriously considered by manufacturers and users alike. It is difficult to generalize on the performance of circuit breakers for motor control, as much depends on the characteristics of the motor under starting conditions which are, in turn, influenced by the duty and condition of the driven machinery.

Metalclad switchgear installations with oil circuit breakers are compact, especially when duplicate busbar arrangements are required, and their design leaves little to be desired as regards safety of operation, accessibility to all parts, and vermin-proof construction. The main insulation of metal-clad compound filled oil break switchgear is free from deterioration due to industrial atmospheric conditions, and the orifice and plug insulators are readily accessible for cleaning. The chief disadvantages of the oil circuit breaker lie in the presence of oil, necessitating provision against fire risk, and, more important, increased maintenance.

Deterioration of switch oil in service takes place owing to contamination with moisture, oxidation and carbonization, the last being a function of the current broken and the frequency of operation. Carbonization, provided it is not excessive, reduces the dielectric strength of the oil slightly, and it does not affect the breaking capacity of the switchgear. For a short period after formation, however, carbon

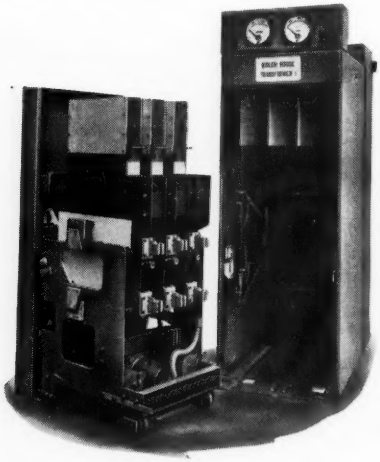


particles do tend to line up on insulating surfaces where electric fields exist, and thus, since carbon is a conductor, creepage distances are reduced. Danger from this source is obviously reduced if the insulation level provided is in excess of the service voltage requirements: for example, where switchgear insulated for 11 kV is used for 3·3 kV service. As it is the custom of manufacturers to supply, for instance, 11 kV switchgear rated at 150 MVA for service on 3·3 kV systems where the fault capacity does not exceed 75 MVA, some advantage may be taken of this to improve the economical performance of oil circuit breakers by allowing the dielectric strength of the switch oil to fall below the figure of 30 kV for one minute, specified in B.S. 148–1951. This has already been justified to a large extent in one works with well over a hundred 3·3 kV motors operating under various conditions. The practice

Metalclad switchgear installations with oil circuit breakers are compact and their design leaves little to be desired for safety and accessibility

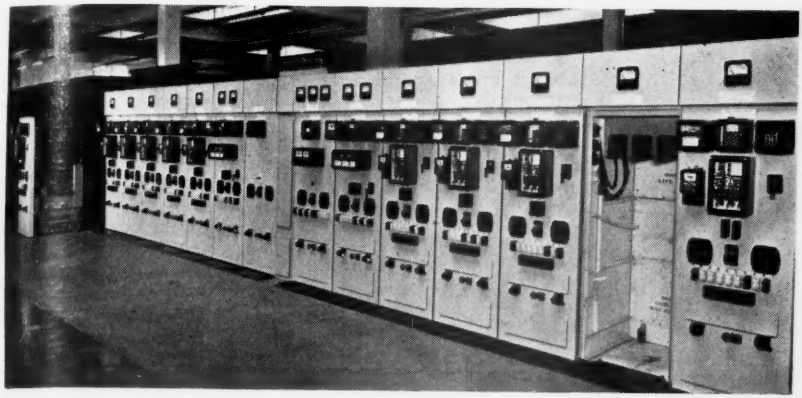
can only be justified by operating experience, since it must result in some encroachment upon the insulation security of the switchgear. The 20 kV figure has been proved safe, and providing that the gear is inspected regularly and the insulators kept free from carbon sludge deposits, the saving per annum is appreciable on a large installation.

During the past five years air circuit breakers have been increasingly applied to the control of direct-on starting 3·3 kV motors. This has formed part of the general tendency since the war towards the use of air break switchgear for the control of power station auxiliaries. From a purely technical point of view there is nothing to choose between air break and oil break equipment for this duty, but air break equipment has found favour from the maintenance standpoint. Air circuit breakers are claimed to be generally more accessible than oil circuit breakers, and their maintenance is simplified by the absence of oil. On air break switchgear, all insulation is exposed, to some extent at least, to the atmosphere, and cleaning of the whole panel is an essential maintenance requirement.



During the past five years air circuit breakers have been increasingly applied to the control of direct-on starting 3·3 kV motors

As indicated in the table (page 279), the minimum rating available at present for an air circuit breaker is 150 MVA at 3·3 kV. While this rating meets the requirements of modern power stations for the control of boiler and turbine auxiliaries, its application in industry must remain limited, chiefly on the grounds of cost. Industrial



Air circuit breakers are claimed to be generally more accessible than oil circuit breakers

distribution systems can be given a greater degree of flexibility than those in power stations, where the tendency is to operate on the unit system employing relatively large unit transformers for this purpose. It is possible, and desirable in many industrial installations, by suitable sectionalizing, to limit the short circuit power on the 3·3 kV systems to 75 MVA. It is for application on such systems, the author thinks, that manufacturers should produce an air circuit breaker with an equivalent rating, at a cost competitive with other types of motor starting equipment.

Contactors with h.r.c. fuse back-up protection may also be considered for direct-on-line starting. They are designed for numbers of operations greatly in excess of those to be expected from circuit breakers, and as a result the mechanism and contact arrangement of the unit is simple and not so prone to trouble. While cartridge fuses have the inherent ability to cut off the fault current at a value less than the full prospective current, this does not necessarily imply satisfactory performance under all conditions. The associated contactor, including its connections to the fuses, must in addition have sufficient through fault rating to withstand the electro-mechanical forces, set up by the current passed by the fuse, long enough to allow the fuse to relieve the condition. Actual short circuit tests on complete integrated fuse contactor units are necessary before this can be accepted with confidence.

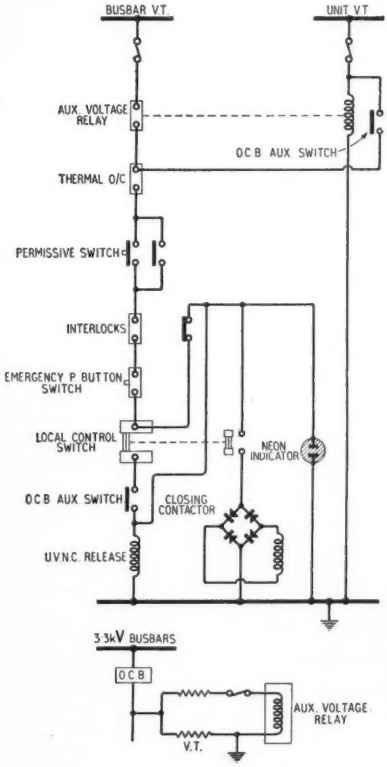
The selection of the correct fuse rating is of first importance and should be made so as to avoid unnecessary interruptions in supply by employing fuses of too small a rating; at the same time one must ensure, as far as possible, that the contactor is not called upon to interrupt currents in excess of its capacity. Although a British Standard Specification for fuses above 660 V has not yet been issued, a rupturing capacity of the equivalent of 150 MVA, at 3·3 kV, three-phase, has been assigned to cartridge fuse links produced by certain manufacturers based on three-phase tests which have been successfully carried out.

The present maximum rating for a single fuse is 180 A, which is suitable for the direct-on-line starting of motors of about 300 h.p., but it is possible, by employing two 180 A fuses per phase, to cater for motors up to 750 h.p. This, however, is not an ideal arrangement, and until single fuses of higher current ratings are available the use of contactors for this particular application must be considered limited. Attention is also directed to the provision of full mechanical interlocking for the safe operation and maintenance of such units.

Protection

For the more important industrial applications involving large capacity motors and switchgear, it is usual to employ thermal overload relays, the principle being that the thermal element of the relay is heated

in proportion to the temperature rise of the machine. These relays also incorporate instantaneous short circuit protection and, where required, earth leakage protection. A further valuable feature is also provided, namely, protection against loss or partial loss of any phase. Under-voltage protection is necessary to guard a machine operator from injury, if his machine starts unexpectedly. Where a large number of motors are supplied from one switchboard it is necessary to provide against attempts to start them simultaneously after a supply failure. This would probably result in the incoming supply tripping. Another scheme for providing against this is mentioned later.



Schematic diagram for motor control by oil circuit breaker; also shows one method of enabling main circuit breaker to be closed so as to energize its own voltage transformer

Under-voltage protection is generally provided on most circuits, except in the case of vital auxiliaries in power stations and industrial establishments. Due sometimes to a specific requirement of the drive or other circumstances, it is not desirable, even in these cases, to dispense with under-voltage protection, and one is then faced with the problem of providing a reliable source of supply to the under-voltage circuit. It is customary on some switchboards to obtain a supply from a busbar voltage transformer, each motor circuit then being supplied through suitable fuses from bus wires which usually run the full length of the board, and are supplied from the secondary winding of the busbar voltage transformer. However, there are a number of hazards in this method, any of which may result in the tripping of all motors; for example, the inadvertent failure of the voltage transformer h.v. or l.v. fuses, a fault on the secondary busbar wiring, and the possibility of the individual circuit fuses failing to discriminate with the busbar voltage transformer fuses.

An alternative is the provision of a separate voltage transformer for each motor circuit. This is a more expensive method, but it should be considered in the light of the importance of the drive. Although not practicable on all types of switchgear, voltage transformers, when connected directly to the busbars, provide the most reliable source of supply for under-voltage circuits. Where it is not practicable to connect all the voltage transformers direct to the busbars, they may be connected to the cable side of the switch, but a difficulty in this case is the provision of a supply to the under-voltage circuit to enable the main circuit breaker to be closed in order to energize its own voltage transformer. This can be solved in a number of ways, and a schematic diagram for one circuit is shown in an accompanying illustration in conjunction with which it should be observed that for closing the oil circuit breaker the " under-voltage no-close " relay is energized from the busbar voltage transformer. When the oil circuit breaker closes the feeder voltage transformer maintains the " under-voltage no-close " relay via the oil circuit breaker auxiliary switch. The auxiliary relay which is operated from the feeder voltage transformer opens a contact and isolates the busbar voltage transformer. During this operation the voltage trans-

formers are momentarily paralleled.

Control

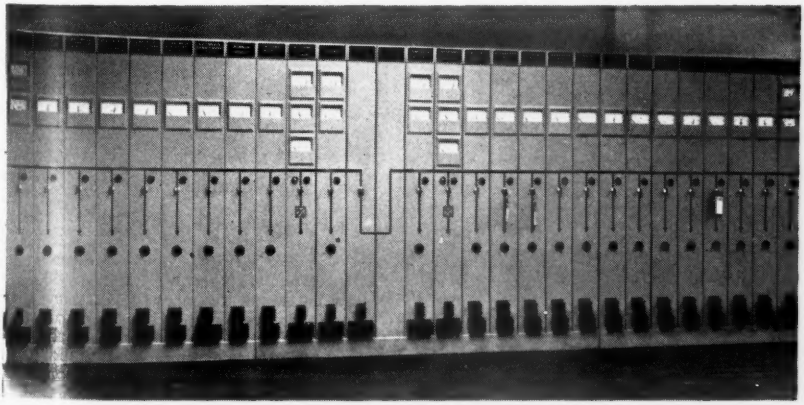
Where there is a large number of such 3·3 kV drives it becomes essential to control the starting by permissive switching, and in the case of the 3·3 kV auxiliaries of a continuous hot strip mill all the machines are started direct-on for an aggregate of 10,440 h.p. for the 20 individual drives. The permissive switching includes the following features: The motor cannot be started from the local position unless the permissive switch is in the "on" position; an indicating light on the local control panel informs the operator whether or not he has "permission"; the motor cannot be started directly by the operation of the permissive switch; it can be started only from the local position; the motor switch can be tripped out, either locally or by the permissive switch; once the motor has started up "permission" can be withdrawn, so that in the event of the motor being shut down it cannot be restarted until the permissive switch is restored to the "on" position.

Contactors with h.r.c. fuse back-up protection may also be considered for direct-on-line starting of 3·3 kV motors: 115 h.p. motors driving pumps so controlled by contactors in cubicles

The Motor

Synchronous motors may have either laminated poles with s.c. windings, or solid steel poles, and pole shoes, without s.c. windings. The starting action is similar in both cases. In the case of laminated poles with s.c. windings the motor is started and runs up to speed by means of the torque exerted by the currents induced in the s.c. windings in the pole face, similar to the

In the case of the 3·3 kV auxiliaries of a continuous hot strip mill all the motors are controlled from a central control board, with permissive switching



"procedure" in a s.c. induction motor. One advantage of this method is that, by varying the resistance of the s.c. winding, it is possible to vary the breakaway and pull-in torques to suit its particular duty. A low resistance s.c. winding made of copper gives rather a poor breakaway torque, but on the other hand it affords an extremely good pull-in torque, while a high resistance s.c. winding offers high breakaway and pull-in torques.

Where solid steel poles and pole shoes without s.c. windings are employed currents are induced in the solid steel pole shoes during the starting period and the motor runs up to speed in a similar manner to that with the pole face winding. It is normal to use solid steel poles and pole shoes on high speed machines as they contribute to extremely strong mechanical construction; but the breakaway and pull-in torques are not so good as those obtained with s.c. windings. This type of construction is suitable for motors with light starting conditions, such as motor-generator sets, etc., where the breakaway and pull-in torques required are comparatively small. For direct-on-line starting the starting currents will be six to eight times the motor full load, although the oscillograph record on page 278 shows that in this particular case the starting current is only four to five times the motor full load. This is accounted for by the appreciable fall in supply voltage caused by the motor starting direct-on-line.

It is not generally fully understood how switching a motor over rapidly from one supply to another can, in certain circumstances, be harmful to the motor. It is sometimes necessary, due to failure of one supply, to transfer to a stand-by supply, or, as in the case of power station auxiliaries, to start up on a pilot set or public supply, and then transfer to the main alternator. When the supply to a s.r. or s.c. motor is interrupted the stator voltage does not die away immediately, owing to inductance between rotor and stator which induces voltage in the stator winding, initially nearly equal to the supply voltage and decreasing to zero after a period of several seconds. If the supply voltage is restored, say, within 1 or 1½ seconds after interruption, i.e., before the induced voltage has fallen to a negligible value, the motor may take a surge of approximately 30 times full load current, depending on the relative phase angles of the induced and supply voltages. Under these conditions the motor windings are subjected to forces which may cause winding failures.

Medium size motors up to 75 h.p. at 400 V have generally a greater safety factor than large machines, and this problem is not of great concern. Small h.p. motors on a 3·3 kV system, however, have a small copper section and consequently the windings are not so robust and are liable to break down under the conditions outlined. By introducing a delay in the change-over of supply of some 2 to 3 seconds, or more, the induced voltage will be decreased to a negligible quantity and the possibility of harming the motor is removed. Depending on the application, it may not be practicable to allow the driven apparatus to slow down below a certain level, or to come to a stop, and it is then necessary either to introduce greater inertia or to adjust the time delay.

The author wishes to thank the Steel Company of Wales, Ltd., for permission to publish this article and the photographs, and also the electrical manufacturing firms who kindly supplied information.

Magnetic Materials

AN illustrated technical publication of 64 pages entitled "Permanent Magnets" has been issued by Mullard, Ltd., Century House, Shaftesbury Avenue, London, W.C.2, to meet the needs of engineers and designers who require an up-to-date and authoritative reference book on the performance and characteristics of modern permanent magnets. A feature of this book is the inclusion of comparative charts and characteristics relating to all permanent magnets commercially available at the present time. Reference is also made to the magnetic behaviour of the commercial irons and steels normally used in conjunction with permanent magnet alloys. Other topics are concerned with the manufacture, design and performance, characteristics and applications of Mullard "Ticonal" cast and sintered magnets, "Magnadur" ceramic magnets, and "Reco" cast magnets. There is also a section dealing with magnetic symbols and terms.

Another of the company's new publications is a comprehensive source of reference on "Ferroxcube" magnetic ferrites. This 40-page publication opens with an historical survey of magnetic ferrites followed by details of their physical structure. The electrical, mechanical and magnetic properties of "Ferroxcube" are then discussed, together with application data and standard core shapes and dimensions.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Minister of Fuel and Power has appointed **Mr. T. E. Daniel,** M.Eng., A.M.I.Mech.E., M.I.E.E., as deputy chairman of the North Western Electricity Board in succession to **Mr. R. A. S. Thwaites,** B.Sc., M.I.Mech.E., M.I.C.E., M.I.E.E., who, as we have already reported, is retiring.

Mr. T. E. Daniel

Mr. Daniel has been the deputy chairman of the North Eastern Electricity Board since 1948, and will take up his new appointment on 1st September next. He commenced his career as a trainee with the Northmet Power Co. in 1923, and in the following year joined the Battersea Borough Council as technical assistant, remaining there until 1932, when he took up the position of deputy borough electrical engineer at Ashton-under-Lyne, becoming borough electrical engineer in the following year. In 1937 he went to Darlington as borough electrical engineer, and upon the formation of the North Eastern Electricity Board in 1948 became deputy chairman of the Board. Mr. Daniel was chairman of the North Eastern Centre of the Institution of Electrical Engineers for 1949-50.

Mr. C. C. Bates, M.I.W., A.M.I.P.E., has been appointed chief welding engineer of Costain-John Brown, Ltd. In addition he will be responsible for the technical supervision of Welding Supervision, Ltd., their associate company. Mr. Bates joined Costain-John Brown, Ltd., from the British Welding Research Association, where for the past four years he was one of the senior development engineers. Before joining the B.W.R.A., Mr. Bates was with Under Water Welders & Repairers, Ltd., before which he spent eight years in the Ministry of Supply.

The eighth examination under the diploma scheme of the Association of Supervising Electrical Engineers was held at various centres on 21st May last, and **Mr. Arthur Allen,** of Keighley, Yorks, was the successful candidate in electrical maintenance. An announcement in respect of the 1954 examinations will be made in November next.

At the annual meeting of Simms Motor Units, Ltd., on 23rd July, **Mr. T. Thorneycroft** decided not to offer himself for re-election as chairman of the company, and **Mr. G. E. Liardet** accepted the appointment as chairman in addition to his duties as managing director.

Mr. W. Newland, export manager of Simms Motor Units, Ltd., left by air on 31st July for a tour of Belgium and Scandinavia.

Mr. Rice Parry Jones, manager of the Halesowen District of the Midlands Electricity Board, is to retire at the end of September. Mr. Jones was with the former Shropshire, Worcestershire & Staffordshire Electric Power Co., and was district engineer at Halesowen from 1940 to vesting date.

Mr. H. W. Grimmitt, M.I.E.E., A.M.I.Mech.E., at present deputy chief engineering inspector in the Electricity Division of the Ministry of Fuel and Power, has been promoted to be chief engineering inspector with effect from 1st September in succession to **Mr. A. N. East,** C.B.E., M.I.E.E., A.I.C.E., M.I.Mech.E., whose forthcoming retirement we have already reported. Mr. Grimmitt was appointed to his present post on the winding up of the Electricity Commissioners in September, 1948. He had served with the Commissioners since 1930. He is hon. treasurer of the Institution of Electrical Engineers, and is a past chairman of the Supply Section of the Institution.

Mr. H. W. Grimmitt

The Minister of Supply has appointed **Mr. W. J. Richards,** C.B.E., to be Director of the Radar Research Establishment. Mr. Richards is at present the chief superintendent of the Telecommunications Research Establishment,

Malvern. As stated by the Minister of Supply in a written reply to a parliamentary question, the two Ministry of Supply electronic experimental stations at Malvern will be amalgamated as from 1st September, and will be known as the Radar Research Establishment. Mr. Richards joined the Royal Aircraft Establishment, Farnborough, in 1925. At the outbreak of the war he was head of the Instrument and Photographic Department at that Establishment. He was appointed Deputy Director of Scientific Research (Armament) at the Ministry of Aircraft Production, where he remained until 1946 when he was appointed the chief superintendent, T.R.E.

Mr. R. F. Richardson, M.B.E., A.M.I.E.E., a member of the commercial manager's staff of the British Electricity Authority, has been appointed an assistant commercial manager. He succeeds **Mr. F. S. Naylor,** B.Sc.(Eng.), M.I.E.E., A.C.G.I., whose appointment as specifications and contracts engineer was announced recently. Mr. Richardson received his early training with Callender's Cable and Construction Co., Ltd., with whom he spent seven years. He entered the electricity supply industry in 1936 as a sales engineer, first with the Westminster Electric Supply Corporation and later with London Associated Electricity Undertakings. After the war, in which he served as an electrical and mechanical officer, he returned to Central London Electricity, Ltd., and was in charge of the St. James and Mayfair districts until 1948 when, following a brief period as district commercial officer at Ilford, he was appointed a section head in the Commercial Department of the London Electricity Board (North Eastern Sub-Area). Mr. Richardson joined the Commercial Department of the B.E.A. last year, where he has been working on a wide range of problems affecting the economic and utilization aspects of electricity supply.

Mr. R. F. Richardson

The final for the Southern Area of the **E.I.B.A. National Golf Championship** was held recently at the High Post Golf Course, near Salisbury. The golf was excellent and extremely competitive, only one stroke dividing the first four players. The following will now qualify for the National Final at Leeds in September :—Messrs. L. Chittenden, Alan Hunt and A. B. Burgess.

Sir John McLean Duncanson has been appointed to the board of Fescol, Ltd.

OBITUARY

Mr. Philip James Watts, O.B.E., M.I.E.E., died at Tiverton on 31st July at the age of eighty. Until his retirement in 1934 he was superintending electrical engineer at Gibralta Dockyard. Previously he was borough electrical engineer at Whitehaven and chief assistant electrical engineer at Devonport Dockyard.

WILLS

Mr. W. H. T. Hayward, works director of W. H. Sanders (Electronics), Ltd., who died on 27th February, left £3,679 gross (£3,421 net).

Mr. T. D. Boldy, chief electrical engineer, Government of Burma, who died on 22nd March, left estate in Great Britain valued at £3,851 gross (£3,739 net).

Mr. G. W. Steward, former electrical engineer and manager to Lowestoft Corporation, who died on 27th November, left £2,266 gross (£2,207 net).

Mr. A. Wright, late engineer and manager of Sidcup and Northwood Electricity Supply Companies, who died on 16th January last, left £2,398 gross (£2,386 net).

Mr. G. P. Tutcher, F.C.I.S., first secretary of the South Wales Electrical Power Distribution Co., Ltd., who died on 10th April last, left £24,260 gross (£24,191 net).

Large Transformer for Canada

THE first of four 71,000 kVA, 301 kV, single-phase Ferranti generator transformers for the "Alcan" project of the Aluminum Co. of Canada, Ltd., Kemano, British Columbia, left the Ferranti factory at Hollinwood on Tuesday last. These transformers are the first power units to be ordered and manufactured in this country for a working voltage in excess of 300 kV. The transformers will be installed in underground cubicles hewn out of solid rock about 300ft below ground in the wilderness of N.W. Canada, 400 miles north of Vancouver, towards the southern tip of Alaska. Ferranti, Ltd., is also supplying three 37,000 kVA, 275 kV transformers to step down the voltage at the other end of the line at Kitimat, where the aluminium production plant will be installed.

The completed transformer travelled via the East Lancashire Road and was ready for loading on to the boat at Liverpool Docks on Thursday. The total weight of the convoy, including trailer, was approximately 100 tons. This contract is one of several dollar contracts for large power transformers received by Ferranti, Ltd., for North America. The total value of all the transformers being supplied by the company for the "Alcan" project is approximately $700,000.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Lamps for Street Lighting

THE choice of sub-title to the article by Mr. F. H. Pulvermacher on "Lamps for Street Lighting" (10th July issue) is most apt. It is indeed a most controversial plea, and a study of the economics of street lighting shows the danger of generalization on this subject.

Costs and comparisons cannot be based on a single set of circumstances and it is wrong to produce one set of figures and represent these as a complete picture. The variation of half a dozen factors which all contribute vitally to the comparison picture can produce any pattern one wishes. It is possible to show 4/80 W fluorescent lamps as an attractive economic proposition under certain circumstances. More pertinent, however, is the fact that whilst 250 W high-pressure mercury vapour lamps will nearly always tend to be at an economic disadvantage when compared with 140 W sodium, this is by no means true of 400 W h.p.m.v. lamps.

The problem of standardization of light sources for street lighting is not so simple as Mr. Pulvermacher suggests, and from the psychological aspect it is a brave man indeed who will sign the order to prevent the use of h.p.m.v. lamps.

Liverpool. J. L. McCAULEY,
Manager,
Exterior Lighting Department,
General Electric Co., Ltd.

I HAVE read with interest the letters appearing in your correspondence columns regarding "Lamps for Street Lighting" and agree with many of the points put forward by Mr. Pulvermacher. May I also add that the real criterion of a good street lighting installation is its visibility factor, and whether the night accident rate is reduced?

It is more than ever essential to have first-class street lighting installations with a good visibility factor, and every effort should be made by all authorities concerned to reduce the very high death and injury rate on our roads at the present time. Colour rendering or æsthetic considerations should, for all roads except civic and shopping centres, promenades or public gardens, take second place, a well-planned street lighting scheme with a maximum visibility factor being the first consideration.

The sodium lamp is a light source which makes an excellent contribution towards this end with its high efficiency, in terms of light output, higher than that of any other lamp produced for a similar purpose. Its low power consumption and relatively low brightness, especially in wet weather, are two more factors in favour of its extended use. Mr. Robinson, in his letter, implies that the demand for sodium and mercury lamps is unlikely to expand and that no increase in efficiency can be looked for in that direction. Surely this is incorrect? Much time and money has, and is, being spent by prominent lamp manufacturers in this country to develop and improve both the sodium and the mercury lamps for street lighting, and in fairness it must be said that wherever a good installation of these lamps has been put in the night accident rate has, in most cases, shown a decrease.

I entirely disagree with Mr. Robinson that the fluorescent lamp is the best for street lighting. It is preferable to use this lamp in civic or shopping centres and on promenades or in public gardens where colour discrimination is of importance. For normal road lighting, including through traffic routes, the main considerations should be visibility, safety and the prevention of crime.

Enfield, Middlesex. A. W. GOSTT.

THERE is much to be said for the views put forward by Mr. Pulvermacher in his article "Lamps for Street Lighting" but, as Mr. Robinson points out

in his letter published in your issue of 24th July, the use of fluorescent lamps should be more fully considered before any decision is made on the type of illumination to be employed for new or improved systems of lighting. The question of economics is not the only one to be borne in mind, for the character and æsthetic appearance of the town can be materially altered by the use of colour-distorting light sources, and in recent correspondence in *The Times* attention has been drawn to the city of Cambridge deciding, in spite of protests, to install sodium lighting along the Backs. It is well known that the Corporation of Royal Leamington Spa fought vigorously for the use of fluorescent lighting, not only on the Parade but also along the main roads leading into the town.

The use of fluorescent lamps for street lighting is very popular with the general public and is considered a great improvement on existing forms of lighting by all those concerned with road safety. There is evidence that the use of such lighting is increasing, particularly in town centres, and there are many instances where the Ministry of Transport is contributing towards the capital and running costs of such installations on trunk roads.

To consider the capital cost alone presents a false picture and it should be conjoined with the running cost, for the two together in comparison with other sources of light do not show any appreciable difference; in fact, if a 2/80 W lantern is employed the total costs are lower, and while the lumen output from such a lantern may not be so great as that from a lantern in which other types of discharge lamps are housed, the "visibility factor" is acknowledged to be much greater. A further advantage peculiar to multi-lamp lanterns is that where economic considerations are paramount one or more lamps can be switched off at midnight, still leaving a low but even illumination along a road, which is preferable to "beacon" lighting from the important aspect of road safety.

I should like to draw Mr. Pulvermacher's attention to the extensive use of fluorescent lamps for street lighting purposes in many European countries, particularly in Belgium, where many miles of arterial roads are lighted in this manner. Discussions with the engineers responsible for the installations indicate that not only has it been found that the natural light is much more acceptable to the public but it is also cheaper than other forms of lighting which it has superseded.

PRO BONO PUBLICO.

Domestic Development

WITH reference to the article in your issue of 24th July on "Domestic Development," there are one or two things which require elucidation. First, on page 176, I notice that in dealing with the question of revenue and the cost of supply, the sum of £2 per annum for interest, depreciation, etc., on £55 is stated to be "a totally inadequate figure," whereas on page 178 I notice that 4¼ per cent is considered adequate when dealing with simple hire schemes for domestic apparatus.

Again, on the setting out of the cost of simple hire schemes, I observe that an immersion heater and lagging jacket can be purchased for £7 and would ask what kind of heater has been provided for? After the end of fifteen years (if the heater lasts this time), where is another £13 5s to come from, other than out of the pockets of consumers, with a resultant increase of cost per unit?

My last point concerns the photograph on page 177. What is the pigtail affair trailing down from above the second shelf and winding its way down into or behind the hot water tank; surely it is not the electrical connection?

CAVE CANUM.

[A copy of our correspondent's letter was sent to the author of the article, whose reply is published below. With regard to the illustration of the water heater installation, which was inserted editorially, the photograph was taken in a show house and the wiring had not been permanently secured.—Eds.]

THE figure of 4¼ per cent which I used in calculating the annual charges on an immersion heater installation is, of course, only the interest rate on which the annuity is based and a quick look at the figures will show that the actual annuity is just over 9 per cent of the capital cost. A similar calculation on the capital sum of £55 per house which I quoted as the cost of supplying mains, etc., on a housing estate—but taking a life of 20 years instead of 15 years—would result in an annual charge of £4 2s 9d to cover interest and depreciation. This is more than double the figure of £2 which was all that was left for this purpose

in the example quoted—hence my use of the words " totally inadequate figure."

There are now several makes of immersion heaters and lagging jackets which can be purchased from well-known firms for the cost stated in the article and there is no doubt that these will have a life of 15 years and probably more. The annuity makes full provision for replacement of the complete installation at the end of 15 years and none of the cost of replacement would therefore have to be met out of the charges for electricity.

Nottingham. N. F. MARSH,
Chief Commercial Officer,
East Midlands Electricity Board.

Are Qualifications Necessary?

WHILST I agree with "A.M.I.E.E." (10th July issue) that the salary scales for engineers in the electricity supply industry are "scandalous" I am not so happy about his penultimate paragraph where he implies that it is wrong for the leading engineers in the industry to speak with two voices. At the I.E.E. they would be correct to point out that the fall in status (which is closely allied to remuneration) of the supply engineers will inevitably react unfavourably on the industry in the future. The same engineers attending the National Joint Board, however, do so in their capacity as managers and it is obviously their duty to speak in a managerial voice. Like the management of any firm they have the duty of producing the goods or services at the lowest possible cost, and salaries are a legitimate item to be reduced if possible.

The natural bulwark against excessive zeal in this direction in the supply industry is the Electrical Power Engineers' Association, potentially the most powerful trade union in the country. This organization has an honoured history of successful negotiation up to about the end of the war, since when it has made an almost complete *volte-face* and could now be more correctly described as a junior branch of the Labour Relations Department of the B.E.A. In fairness to the officials who are leading the Association in this direction it should be pointed out that the E.P.E.A. is democratic in its constitution and that the ultimate responsibility rests with the general membership. The only reaction of the vast majority of these to the present condition is to bemoan their fate amongst themselves, but not at any official meetings of the union.

Under these circumstances I would say that the remuneration of electricity supply engineers is just and even generous. Certainly if I were on the managerial side and had anything to do with salary negotiations they would not fare so well.

Portishead. W. S. WILSON.

WITH reference to the correspondence on "Are Qualifications Really Necessary?" I as a qualified electrical engineer would like to state an emphatic "No." The vast majority of the senior engineering executives in the electricity supply industry are not qualified men, and it is safe to say that the bulk of the engineering posts can be filled quite adequately by non-qualified men. The only reason for the insistence, by the B.E.A. and Area Boards, that their younger engineers should possess qualifications before being given an appointment is the fact that the technical colleges and universities have provided such a plentiful supply of graduates, a supply which far exceeds the demand. It pays the B.E.A. and Area Boards to cry out that there is a shortage of qualified men, but the simple economic law of "supply and demand" proves their claim to be false. Graduates with five to ten years' experience would not have to be content with weekly wages of from £7 10s to £9 10s per week if this was not so.

These facts may also explain the industries' apparent indifference to the qualifications and claims of your two previous correspondents on this subject.

"DISGRUNTLED."

[A glance at available lists of senior engineering executives in the electricity supply industry would have corrected our correspondent's view as to their qualifications. References to the shortage of graduates come to us at least as often from manufacturing companies.—Eds., *Electrical Review*.]

British Columbian Development

Expenditure of $13 million on adding 120,500 h.p. to the power system of the B.C. Electric Co. during the next two years has been announced by Mr. A. E. Grauer, president of the company. Mr. Grauer states that a 62,000 h.p. unit will be installed at the company's Bridge River plant, which will raise its capacity to 248,000 h.p. In addition, surveys are being completed and work is to start this autumn on a power station at the mouth of Seton Creek, about 25 miles east of the present Bridge River plant.

Industry and the House

Science and Production

By A. M. F. PALMER, A.M.I.E.E., M.P.

BY the time these notes appear in print the House of Commons will have adjourned for the summer recess. On the whole these recent months have been free from strong controversy, to which condition the atmosphere of the Coronation has contributed a great deal.

From that neutral point of view which finds expression in these columns, the quietness of Parliament has been valuable; it has enabled more time to be devoted to industrial and technical questions which, although not politically exciting, are of vast importance to the country and its welfare. Monday has become increasingly the day for such questions to be discussed. A typical Monday was a fortnight ago when, at question time, Mr. Duncan Sandys announced that directions had been given to abandon the Brabazon airliner project.

Mr. Sandys told the Commons that in the view of the Government further expenditure would not be justified on these monster machines, but he was satisfied that valuable technical information had been obtained for the future. Although a costly experiment it had provided knowledge, for instance, on the methods of reducing structural weight, overcoming stresses in large airframes, and in connection with the development of more efficient power controls and electrical systems.

Apparently nearly £7 million has been spent on the Brabazon experiment in general, and the House was a little shocked to learn that £6 million additional expenditure had been incurred in runways and buildings. However, these are, of course, available for new developments.

Immediately after questions on this day the House went into Committee of Supply, when Mr. Stokes opened for the Opposition a general debate on science and industry. Mr. Stokes is an interesting figure. He combines in his large and generous person the distinction of being both a successful industrialist and a former Labour Minister. Although no parliamentary orator in the classical sense, he is an engaging figure at the dispatch box; he speaks with a breezy directness which must be seen—not just heard—to be believed.

Mr. Stokes thought that improved productivity depended largely upon good understanding between management and workpeople. Employers, in his experience, could only get the best out of their men by explaining what they wanted done, why they wanted it, and ensuring finally that the men had a fair share of " the swag." He was obviously under no illusions about material rewards; people who work for nothing, he said, went either to a nunnery or a monastery. He added to this dictum the startling revelation, to his friends at least, that he had once thought he would like to be a monk. When it was discovered that all he wanted was to run the monastery, he was told that he lacked a true vocation!

The firms with which Mr. Stokes was connected had devised a scheme by which everyone shared in the benefits of increased production. Since the introduction of this scheme in 1950 average earnings had increased from 58 per cent to 77 per cent above the standard rate and absenteeism had dropped from 2 per cent to one-tenth of 1 per cent. He thought the Government was not doing enough to encourage fuel saving in industry. A firm with an annual fuel bill of £10,000 a year had by insulation reduced it by £3,000. Proper insulation should be allowed as a full revenue charge; failure to install proper insulation should be made a penal offence.

Then followed another interesting member of the House of Commons, Sir William Darling, who sits for Edinburgh South. Sir William has many talents and much personal charm, but I am sure no member of his own party will think me unjust if I say that the Edwardian elegance of his attire is admirably matched by the archaic quaintness of his opinions. He

made a speech of some length which entertained the House, but in the end it all came to this: the best thing the State could do was to leave industry completely alone.

A succession of Members from both sides emphasized familiar points; the need for better management standards, increased joint consultation, greater capital investment, improved research facilities and more trained technologists. Mr. Molson, Parliamentary Secretary to the Ministry of Works, said that the United States with only twice our labour force was spending five to six times as much on equipment. He thought Sir William Darling entirely misinformed when he had argued that in the United States there was less governmental expenditure on research. Through one agency or another the American administration was paying more than half the total expenditure on research on steel, for instance, as compared with only 15 per cent in this country.

Turning to a brighter aspect, Mr. Molson revealed that the universities had doubled the output of technologists in less time than the Barlow Committee had thought possible. The Imperial College of Science was to be extended and by 1962 would be turning out 3,000 technological students as compared with the present annual output of 1,600.

The debate was wound up by Mr. Lee, Labour Member for Newton, who is in the Amalgamated Engineering Union, and Sir Walter Monckton, the conciliatory Conservative Minister of Labour, who invariably charms us, even when he says nothing in particular. On the whole it was an excellent day; in my view another instalment would do no harm, say, six months from now.

PARLIAMENTARY NEWS

By Our Special Reporter

IN the House of Commons last week Mr. Richard Winterbottom asked the Assistant Postmaster General what areas of the country would remain to be covered by the British Broadcasting Corporation's first television coverage after the present authorized programme had been completed.

Mr. Gammans said that the main areas would be the north west part of Scotland, part of South Scotland and North West England, the western part of Northern Ireland, Central Wales, East Anglia, and part of South West Kent. It was too early to say when further stations could be authorized to serve these areas.

Replying to Sir Harold Roper, Mr. Gammans said that in view of the public interest, the Minister of Housing and Local Government had arranged that no decision would be taken as to the use of North Hessary Tor for a television transmitting station until a public inquiry had been held. Later in the week, on the motion for the adjournment, he said that the holding of a public inquiry would certainly delay the erection of an aerial in that part of the country and the provision of television in the Plymouth district.

Rural Electrification in Scotland

Major Anstruther-Gray asked the Secretary of State for Scotland if he would ascertain from the British Electricity Authority to what extent the increased capital expenditure approved for rural electrification would be applied to Scotland and, in particular, to the area of the South East Scotland Electricity Board.

Mr. James Stuart said he understood that the British Electricity Authority still had this matter under consideration.

Radar Research

The Minister of Supply, Mr. Sandys, said he had been reviewing the functions of the two electronic experimental stations at Malvern, one of which was primarily engaged on radar research for the Army and the other for the Air Force and Fleet Air Arm. As a result he had come to the conclusion that it was desirable to integrate more closely all research activities in this field and he had therefore decided to amalgamate these two stations as from 1st September and so create at Malvern a combined organization, working for all three Services, to be known as the Radar Research Establishment.

Nuclear Research

Mr. Molson said that the convention for the establishment of a European Organization for Nuclear Research was signed in Paris on 1st July by a representative of Her Majesty's Government. It provided for collaboration in fundamental research in that part of the field of nuclear physics concerned with very high

energy particles. The organization proposed to build a laboratory near Geneva equipped with accelerators for producing such particles. So far ten countries had signed the convention, and two others were expected to sign very soon. The convention came into force when it had been signed and ratified by a specified number of States. It was hoped that the new organization would begin its work early in 1954. The text of the convention would be laid before Parliament for the customary twenty-one working days before it was ratified.

New Power Houses

Mr. Nabarro asked the Minister of Fuel and Power what steps he was taking to ensure the most economical form of power-house construction compatible with efficiency and the best use of raw material resources.

Mr. Geoffrey Lloyd said that last autumn he appointed a Committee under the chairmanship of Sir Hugh Beaver to examine this question. He had now received its report, which would be published in due course, and he was considering the Committee's recommendations.

Fuel Efficiency

Mr. Nabarro asked the Minister of Fuel and Power whether he would now announce further details of the industrial fuel efficiency non-profit-earning company to be established under the auspices of the British Productivity Council in accordance with the recent recommendations of the report of the Pilkington Committee.

Mr. Geoffrey Lloyd said that the British Productivity Council was giving detailed consideration to the formation of the new industrial fuel efficiency company on the lines of the report of the Pilkington Committee. Further details would not be available until the memorandum and articles of association of the company had been completed.

International Television Relays

A CONFERENCE was held at Broadcasting House, London, from 28th to 30th July to discuss the technical aspects of television programme exchanges in Western Europe. It was attended by the technical representatives of the Belgian, French, German, Netherlands, and British broadcasting organizations, and of the European Broadcasting Union.

Arising from the successful relaying of the Coronation television broadcasts to North-Western Europe, Radiodiffusion-Télévision Française had proposed that during the Christmas period an effort should be made by the television authorities in Belgium, France, Germany, Netherlands and the B.B.C. to join together in producing "live" programmes which would be suitable for broadcasting in all the countries concerned. This proposal was examined from a technical point of view. It appeared that the necessary technical arrangements could be made for interchanges between France, Belgium, the Netherlands and Western Germany. However, it might be some weeks before a decision could be taken on the setting up of a two-way temporary link across the Channel to connect London with the Continental network at Lille, in view of the heavy demands that would be made on equipment and manpower.

The conference agreed that a prolonged test period during 1954, using temporary links where necessary, was very desirable in order to obtain more experience of the interchange of programmes and to get a better idea of the extent to which permanent links would be used.

Views were exchanged on the permanent links which might be set up by the appropriate Posts and Telegraphs Administrations. The conference hoped that these links might form part of a wider network embracing other European countries.

It was noted that plans were already in hand for setting up a network linking France, Belgium and the Netherlands towards the end of this year. It was probable that before long permanent connections would be established between this and the existing West German network. The setting up of a permanent connection between the British and Continental networks was also examined. The conclusion was that such a link was highly desirable, but that its realization was dependent on economic factors which would be discussed with the administrations concerned.

Canadian Marconi Development

WITH the approval of the United Kingdom and Canadian Governments the English Electric Co., Ltd., has agreed to buy from Cable & Wireless, Ltd., the latter's interests in the Canadian Marconi Co. amounting to 50·6 per cent of the share capital. As a result, Marconi's Wireless Telegraph Co., the wholly-owned subsidiary of the English Electric Co., will be reunited, through their common parent company, with the Canadian Marconi Co. which Marconi's founded just over fifty years ago.

The Canadian Marconi Co. will continue to be run by Canadians as a Canadian enterprise for the joint benefit of the two Marconi organizations and the development of the electronic industry in Canada. The full resources in research, development and production of Marconi's Wireless Telegraph and the English Electric Co. will be available to the Canadian company and new impetus will be given to the opening of Canadian dollar markets to British-made Marconi products in the face of strong foreign competition.

Domestic Wiring

Gateway or Bottleneck?

By
PHILIP HONEY
A.M.I.E.E.*

Typical council houses erected in 1928-30 with lighting circuits only. Each service cable feeds one house direct with a 7/·029in sub-service to adjoining house

IN the early days of electrical development domestic wiring could only proceed at the rate that mains and services could be laid to supply the necessary energy. To-day it is wiring which is the limiting factor to electrical development, at least as far as sales of appliances are concerned.

Hundreds of millions of pounds have been spent on new power stations, supergrid lines and transmission and distribution systems to get electricity to the consumer's meter, yet the bottleneck of inadequate wiring, of lack of facilities for using electricity, still exists.

In the twenty years preceding the war the majority of houses which had never been wired before were changed over to electricity and practically all new houses constructed during that period were wired for lighting as a matter of course. It has only been since 1930 that " power " points have been installed to any extent and even these are still very limited in all except a small proportion of homes. The fact remains that a large number of British homes still have only one 5 A lighting circuit with little or no provision for using electrical appliances from plug points.

When these houses were first wired the only appliances with any kind of popularity were the iron and the cleaner. Then came radio and with the two-part tariff the bowl fire. Since those days the list of electrical appliances available has grown enormously and it is true to say that it is these which have encouraged householders and builders to install more plug points.

The average household to-day will probably possess an iron, cleaner, radio or television, a clock or two, one or two small fires and possibly a kettle, and of how many of these can it be said that there is a plug point for each appliance? The bottleneck of inadequate wiring prevents many people from making greater use of electricity and is a bar to the sale of electrical appliances of all kinds.

It is in pre-war council houses where the greatest lack of plug points is probably to be found. Go round any housing estate of this kind at dusk and note the two-way adaptors carrying flex from the centre light to some appliance (or even appliances). Note also the extensions made to lights in garden sheds and outhouses run in flexible cables of all kinds and sizes. Ask the local housing authority's maintenance men how many council houses have unauthorized extensions run in stapled flex to 5 A two-pin socket outlets in these

*Technical liaison officer, British Electrical Development Association.

inadequately electrified homes. The result if officially published would be surprising. How many 5 A circuits habitually carry 10 A or more in the winter?

The danger from fire which arises in such cases is not confined to pre-war council houses. Many homes with rental wiring installations are just as badly in need of inspection and attention. The extensive sale of multi-way adaptors, socket outlets, flex connectors and other accessories by the chain stores shows how great is the demand by the tenant and the householder for facilities to use electrical appliances.

Then there are the blocks of flats erected in the past by both municipal and private enterprise. Unless the electricity authority concerned had a say in the installation specification the rising mains will be found to be not much better than bell wire. Any unfortunate tenant on an upper floor wanting to use more than 1,000 W at a time would be unlucky.

Houses converted into flats are similarly lacking. In some cases the supply authority itself has been the cause of this frugality. By insisting on all meters being placed in one position—close to the service cut-out for convenience of reading—the owner could hardly be blamed for running a pair of 7/·029in cables to each flat.

The argument generally put forward by the authority concerned was that gas was provided to each flat, provision being made for the connection of a cooker, copper, gas fires in each room, and a bathroom geyser. Such dwellings are strictly limited in the use of electricity and it is gratifying to know that in a number of cases the Boards concerned have taken steps to remedy the deficiency. In some city areas vertical distribution is almost as important as horizontal distribution. It is just as necessary to see that the consumer in a fifth floor flat has an adequate supply up to the meter as the householder at the end of a long country lane. A generous provision of plug points is not possible if the supply itself is arbitrarily restricted by the lack of foresight of owners or builders. It is clearly time that something was done to remove this bottleneck and to pave the way to the sale of more appliances by providing more points for their use.

Between the two wars E.D.A. ran some highly successful campaigns with the object of getting new consumers. The first, in 1926, was called the "Wiring of Britain" campaign, and since then the very large majority of homes have indeed been wired. We now need a similar campaign—the "Re-wiring of Britain"—to remedy the inadequacies of the past. There is work here for both Boards and contractors—to make consumers realize the restrictions of their present installations and to call their attention to the danger of long trailing flexes, overloaded plug points, obsolete two-pin socket outlets and amateur extensions, etc.

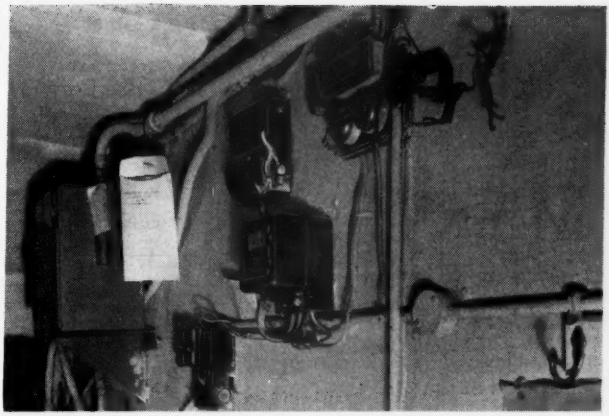
Unfortunately there are still some municipal housing authorities with pre-war mentalities who look upon a gas fire point as a cheaper alternative to an electric plug point. Others think in terms of capital expenditure and the electrical installation is one of the first to suffer when reductions in building cost are required.

The Housing Manual first published by the Government towards the end of the war gave a clear indication of the need for an adequate installation. Its recommendations have been followed more or less by most housing authorities, and by careful planning the cost of the installation has been kept to about 2 per cent of the entire cost of the house. One of their recommendations was the ring main with the laudable object of standardizing the B.S.1363 13 A socket outlet, but already there are signs of a breakaway by cutting the number of full-size heating plug points down to the barest minimum. These are wired on the old distribution fuse board principle, while the remainder of the plug points recommended by the Housing Manual are reduced to 2 A size, which can of course be

Flats with adequate vertical distribution (Hackney Borough Council electrically equipped flats)

connected to the lighting sub-circuits. This tendency should be resisted to the utmost by all those who are concerned with the planning of such installations.

It seems a great pity that even now there are some electrical men who do not wholeheartedly support the industry's attempts to reduce the number of sizes of plug points to a minimum. The B.S. 1363 socket outlet for use with the ring main was the answer to the public's complaint that plug point sizes and types varied from house to house. Yet one hears of architects who assert "I've been advised by my contractor against it," or of consultants who say "All very well for Council houses but not for my client please," and worse still, of the wireman who openly admits that he's "never 'eard of it!"



Inadequate services to flats lead to restricted use of electricity—a typical "hook-up" found in old houses

If we accept the fact that the majority of inadequate electrical installations which still exist are (*a*) dangerous to life and property, (*b*) an open invitation to the amateur wireman to carry out extensions, and (*c*) a bar to the sale of more electrical appliances, the policy of the electrical industry is clearly defined.

We should therefore:—

(1) Start as soon as possible a campaign for adequate wiring and facilities in every house with an electricity supply whether old or new.

(2) Insist on local housing authorities keeping up to Housing Manual standards of electrification.

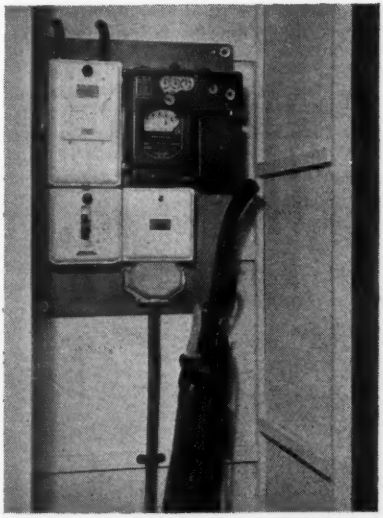
(3) Encourage housing authorities, architects, consultants, and the few unenlightened members of the electrical industry to realize the benefits of, and to make more use of, the ring main.

(4) Look ahead by providing facilities for easily made extensions to the ring main where this is practicable, so lowering the cost of additional plug points which may be required at a later date.

(5) Examine new wiring methods in the light of future requirements. It should not be imagined that the last word has been said in the design of cables, wiring systems, or accessories.

(6) Make it a practice to inquire of the purchaser of any type of electrical appliance whether there is a suitable plug point available for its use. This would go some way to ensure that the appliance would be used correctly and safely.

Modern service units lead to adequate wiring and provision of plug points



Farm Food Cooking

A New Use for Old Boilers

By E. C. Claydon*

MANY high loaded electric steam raisers were installed for dairy work in the days when peak maximum demand was not reflected in the tariffs offered to farmers. Now that fixed charges based on maximum demand are being introduced many of these boilers are becoming redundant and it is to everybody's advantage if alternative uses can be found for them.

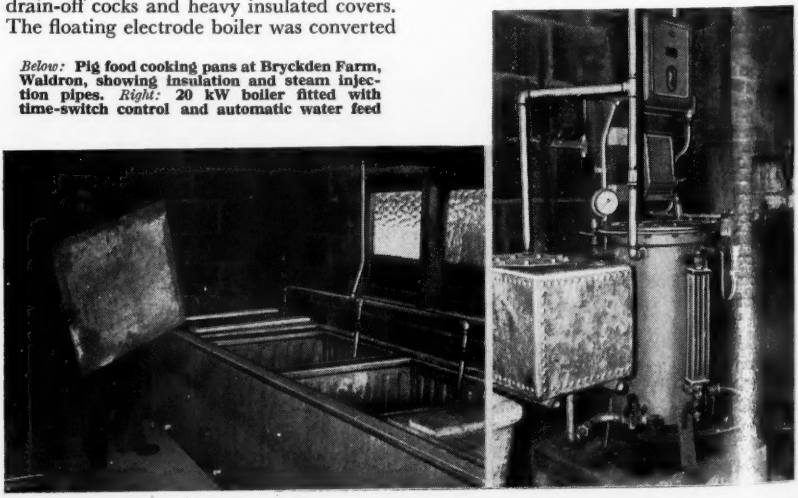
The 20 kW G.E.C. floating electrode steam raiser installed at Bryckden Farm, Waldron, Sussex, went out of use when the milking parlour closed down and the farmer, Mrs. Dawson, inquired regarding its possibilities for cooking pig food, in view of the drawbacks being experienced with their solid fuel fired system. At first it did not appear to be an attractive proposition, but eventually a layout was designed for time-switched operation so that full advantage could be taken of a preferential off-peak tariff.

Six 75 gal highly-insulated steaming pans were installed in the food cooking room and provided with steam injection grids, drain-off cocks and heavy insulated covers. The floating electrode boiler was converted to automatic operation by having a self-feeding supply fitted which maintains a constant water level. When the time-switch control operates, steam is injected into the pans for any predetermined period according to the quantity and nature of the food being cooked. Means are provided to prevent the condensate in the pans from syphoning back into the boiler when the electricity is automatically switched off.

This installation, which is working to the satisfaction of the Electricity Board and the consumer, results in a daily off-peak consumption of between 100 and 200 kWh. The farmer is making full use of equipment already in her possession and is performing an unpleasant task with the minimum of labour, inconvenience and dirt.

The work of conversion was carried out by the Eastbourne District staff of the South Eastern Electricity Board, East Sussex and South West Kent Sub-Area (manager, Mr. N. Boydell).

* Agricultural engineer, South Eastern Electricity Board, East Sussex and South West Kent Sub-Area.



Below: **Pig food cooking pans at Bryckden Farm, Waldron, showing insulation and steam injection pipes.** *Right:* **20 kW boiler fitted with time-switch control and automatic water feed**

Engineering in Europe

Survey of Current Literature

THE volt-ampere efficiency of selenium rectifiers is limited, on one hand, by the blocking potential, and on the other hand by the current heat losses in the forward and reverse directions; up to the war, the blocking potential or withstand voltage in the reverse direction of a single plate was about 18 V (r.m.s.). It is well known that the actual rectifiers consist of a parallel-series arrangement of plates which enables units of the desired VA efficiency, blocking voltage and current-load capacity to be obtained. For some purposes, e.g., electroplating, the blocking voltage is less important than a small voltage drop in the forward direction because this determines ultimately the current-load capacity.

The most recent advances in selenium rectifier construction relate to remarkable increases in the blocking voltage rating which were achieved by an additional pre-treatment of the semi-conducting selenium layer before its deposition on the supporting metal plate and by giving the latter a coat of special varnish. This reduces the required area of the plates and enables blocking voltages of 40 and 60 V to be obtained. While the reverse-current losses remain the same, the voltage drop in a rectifier unit could be reduced by 70 per cent of that of the previous standard types of rectifier. The current-load capacity of a 60 V plate is so improved by about 20 per cent and the VA efficiency by about 200 per cent compared with the previous 20 V standard plate. This development has made great strides in the United States, where types of 5,000 V_{max} and 1–5 mA per unit are available.—" Progress in the Development of Selenium Rectifiers," O. Klein, *E.T.Z.* (*A*), Vol. 74, No. 9, pp. 258–262, 1st May, 1953, in German.

Rheostat Design

The design of rheostats, i.e., starters, step switches, regulating switches or controllers, etc., is still carried out rather unsystematically, although it is by no means difficult to use one method for the most heterogeneous types of rheostats and to determine all the essential parameters of such rheostats from one diagram. Two kinds of " maximum current " determine the layout of a rheostat, one of which is the maximum current which the rheostat is required to pass for achieving its purpose as a controlling element, and the other the maximum current its resistances may carry safely for a prescribed period, or permanently. Obviously, the latter value depends on the thermal load-carrying capacity of the resistance elements, or on the current heat produced in these elements, or the power losses. A suitably developed diagram enables in all cases these quantities to be represented and the resistance steps to be determined for the field regulation of d.c. and a.c. machines of all types, particularly battery-charging, fan drives, and for series, potentiometer or bridge types of control rheostats and even in current-divider circuits of series motor control.—" The Design of Rheostats," K. Dietrich, *E.u.M.*, Vol. 70, No. 9, pp. 189–197, 1st May, 1953, in German.

Steel Tower Foundations

A brief, but useful, survey has been made of foundation engineering, based on the most recent developments in many countries and considering soil types, climatic conditions, corrosion proofness and protection and, more particularly, economic factors. The first examples shown are divided foundations, one with embedded stub angle and one with a steel anchor embedded in concrete, for marshy ground. On rocky ground, cemented-in foundation bolts (rock anchors) represent the simplest solution. Wooden and metal sleepers and grilles are cheap and reliable solutions for other types of ground. Wide-base towers, owing to their higher intrinsic stability, are reliably founded on narrow buried concrete columns. Particular attention is drawn to the Russian practice of using prefabricated elements for ferro-concrete tower foundations.—" Design of Foundations of Steel Towers

for H.V. Overhead Lines," B. Perlin and M. Karmasin, *Elektrotechn. Obz.*, Vol. 42, No. 3, pp. 155–160, March, 1953, in Czech.

Reduction of Transformer Hum

There are two main sources of transformer hum, the lesser being vibrations of the windings set up by electromagnetic forces between parallel conductors, and the predominant one magnetostriction in the transformer sheets. The fundamental frequency of the noise is not the system frequency f, but 2f, which is easily understood by considering the simultaneous expansion of the sheets in two opposite directions under magnetostriction effects. The frequency spectra represented show that the harmonics up to 20f (i.e., the 10th harmonic of the noise fundamental) contribute more to the general noise level and are actually more strongly felt by the human ear than the fundamental.

Means for reducing the noise produced are: (1) Reduction of magnetostriction by using oriented-crystal transformer sheets instead of the ordinary sheet materials; (2) eliminating resonance and reverberation effects by suitable alterations of the transformer design; and (3) using sound absorption means. The optimum solution will represent a compromise between technical and economic considerations, since it is estimated that a reduction of the noise level by 3 db will increase the total cost of a 20 MVA unit by 2 per cent, but of a unit up to 2 MVA by up to 22 per cent. The report refers to work carried out in the Allis-Chalmers works, Pittsburgh, U.S.A.—"Transformer Noise," K. B. Munter, *Ingenioren*, Vol. 62, No. 19, pp. 386–388, 9th May, 1953, in Danish.

Choosing Surge Divertors

A discussion of the necessary and desirable characteristics of divertors is prefaced by a clear exposition of the dangerous and more innocuous types of surge, atmospheric and switching surges, and those electrostatically and electromagnetically induced. The main part of the article deals with thyrite arrestors, expulsion-type and rod spark gaps. It is important that a well-designed divertor shall render harmless only the dangerous peak of the surge and that the line insulation shall be restored to its full previous level as soon as possible.

The resistance of thyrite arrestors is roughly inversely proportional to the voltage applied, but the discharge current to earth is proportional to a higher power of the surge voltage. But for this fact the voltage set up across the divertor during its discharge might become dangerously high for the protected system. The stability and constancy of the divertor in all respects are basic conditions.

Divertors must be easy to inspect and so placed that even their destruction by a direct stroke cannot damage neighbouring parts of the plant. The author then discusses the C.E.I. regulations on divertors and presents typical discharge current-residual voltage characteristics of divertors investigated. The last section deals with divertor testing equipment and its use.—"Some Considerations on the Choice of Surge Divertors," G. Paleari, *Energia Elett.*, Vol. 30, No. 3, pp. 157–165, March, 1953, in Italian.

Fluorescent Lamps and Auxiliaries

A comprehensive survey has been made of the characteristics of modern fluorescent lamps and their auxiliaries from the point of view of the supply engineer. It enters into the details of the interrelations of ignition and stabilization, reliability of the ignition, stability of operation and regulation factor, load characteristics of the auxiliaries, form factor of the discharge current and extinction interval, waveform of absorbed current and impedance characteristics of whole installations, and it introduces the theoretical determination of the most suitable compensation circuits for any given installation. The special part treating of these compensating circuits deals first with shunt compensation and its circuit parameters, presenting a method for calculating the theoretical load characteristics and impedance characteristics of a shunt-compensated installation, and then explains the corresponding, but much more complicated, problem and method of series compensation. The methods are illustrated by numerical examples and their results confirmed by oscillograms.—"Fluorescent Lamps and their Stabilizers: Compensation of the Power Factor," H. Thesio. *Bull. Sci. Assoc. Ingen. Montefiore*, Vol. 65, pp. 1255–1300, December, 1952, in French.

Readers who require accurate full translations of any of the articles abstracted in this section can be put in touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

COMMERCE and INDUSTRY

Summons Against B.E.A. Dismissed

Transitional Copper Trading Arrangements

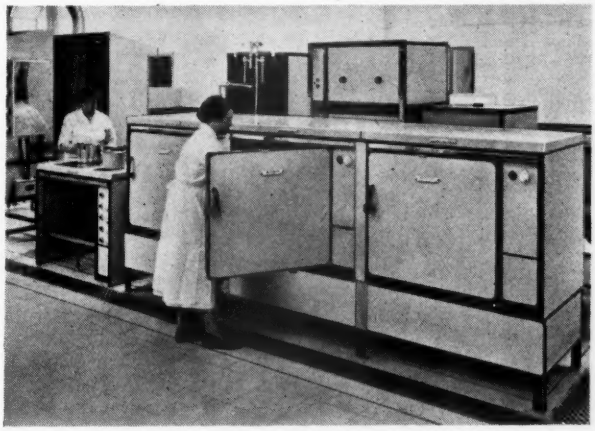
A SUMMONS by the Attorney General against the British Electricity Authority was dismissed at Bow Street Police Court last week. The Authority was accused of dispersing 400 pamphlets, entitled "The Place of Electricity in the Nation's Fuel and Power Policy," on which the name and place of the printer did not appear. Sir Laurence Dunne, the magistrate, found that it was an official document for the execution of the offices of a public body.

B.E.A.M.A. Dinner

In order to avoid clashing with another electrical function, the British Electrical and Allied Manufacturers' Association has changed the date of its annual dinner from 18th November to Monday, 16th November. As already announced, the dinner will be held at Grosvenor House, London, W.

Canteen Equipment

A feature of the "Creda" heavy duty cooking equipment installation in the canteen kitchen at the new works at Hirwaun, Glamorgan, of the Dunlop Rubber Co., Ltd., is the method of mounting on a common stand a three-oven general purpose roaster. As the accompanying picture shows, by raising the ovens off the floor the cooks can deal with the various dishes at a convenient working height. Similarly, the two-pan boiling tables are built to a height which allows the cook to see into the utensils without strain. The roasters are butted up in line formation and the boiling tables in island formation. The oven of the roaster has two-stage thermostat control which ensures fast heating up with low maintenance consumption. Other "Creda" equipment supplied by the Simplex Electric Co., Ltd., includes a 16 gal stock pot and stand; a three-deck pastry oven, an all-vitreous enamelled proving oven, electrically heated food conveyor and a quantity of ancillary equipment.



"Creda" cooking equipment installed at the Dunlop Works at Hirwaun

Private Trading in Copper

The Ministry of Materials announced last week the Government's plans for facilitating the return of copper to private trading, which was resumed on Wednesday. The Ministry has arranged to supply copper to the United Kingdom market during the transitional period of a few months. During this period the Ministry will still be importing copper bought up to 4th August, 1953. In order to fill the gap that will occur between 5th August and the time at which supplies through trade channels can reach this country in sufficient quantities there will be releases from the Government's trading stocks. The amount to be released is at present estimated at about 60,000 tons. It will be available for sale through normal commercial channels. The prices at which these sales (apart from sales direct to consignment stockholders) will be made will be based on the average market price over an extended period of months. The releases represent no addition to the metal which would in any case be

delivered in the United Kingdom to meet the requirements of consumers.

As with tin, lead and zinc, there will be a Government broker to handle Ministry sales of copper on the London Metal Exchange, and the Minister has appointed Mr. L. Guy, of C. Tennant Sons & Co., Ltd., to act as Government broker. He will be a seller only when the needs of the market cannot be met from other sources. Details of the procedure whereby non-standard copper may be obtained from the Government broker in exceptional cases of need are being made known separately.

The arrangements described above represent the present limit of intended sales of Ministry copper to the market (apart from small continuing sales of copper bought under a long-term contract). Some of the remaining stocks will not, however, be transferred to the strategic stockpile at present, and the Ministry reserves the right to dispose of further quantities if developments, in the opinion of the Government, so require. Arrangements for exports will be announced by the Board of Trade shortly.

High-Conductivity Copper

Because of anomalies in certain British Standards dealing with annealed and hard-drawn high-conductivity copper, the British Standards Institution has issued at 2s 6d a memorandum on "Values for the properties of high-conductivity copper," to form a common foundation on which to base future British Standards and revisions of existing standards.

This memorandum, B.S.1989, contains recommendations based on Publication 28, "International standard of resistance for copper" of the International Electrotechnical Commission. Values are given of resistivity, density, coefficient of linear expansion and constant-mass temperature-coefficient of resistance. Tables are given for converting resistances at one temperature to values at other temperatures. A note explains the effect of the change recently made from international to absolute electrical units.

E.I.B.A. Sussex Centre

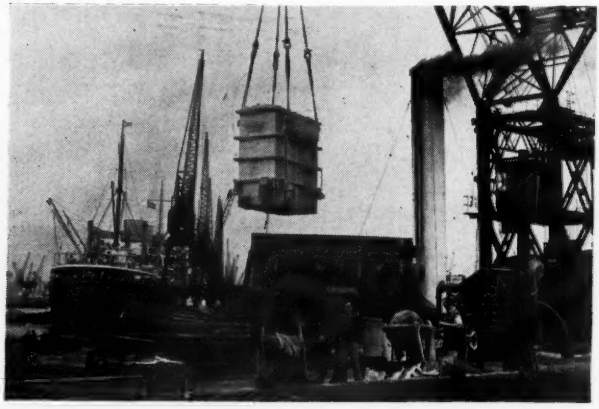
The annual ball of the Sussex Centre of the Electrical Industries Benevolent Association will be held on 29th January at the Grand Hotel, Brighton. The hon. secretary of the Centre is Mr. T. H. Batchelor, 10, Queen's Gardens, Hove, 3.

Colliery Year Book

The 31st edition of the "Colliery Year Book and Coal Trades Directory," published by the Louis Cassier Co., Ltd., Dorset House, Stamford Street, London, S.E.1., at 30s net (31s 3d by post) presents in a convenient and reliable form the fullest information of the coal mining and allied industries. Although new features have been introduced the general layout follows the pattern of past editions, and the whole work has been thoroughly revised. A foreword is contributed by Mr. Geoffrey Lloyd, Minister of Fuel and Power. Partly as a result of inquiries from readers and partly due to modern trends, some facts and figures on coal mines in Western Europe have been introduced in this edition. The Department of Scientific and Industrial Research has been given more space and information on the new education scheme for the British Coking Industry Association has been included.

Transformers for India

In connection with the various river valley projects of the Government of India, eight 15,000 kVA 132/33 kV Hackbridge transformers are being supplied to the Damodar Valley Corporation one of which, in course of shipment, is shown in the accompanying picture. These transformers are of the three-phase, outdoor, oil filled type arranged for natural/forced draught cooling by means of a separate cooling unit placed in line with the transformer. Natural cooling obtains until the transformer is carrying 60 per cent of full load when



One of eight Hackbridge transformers in course of shipment for the Government of India

forced cooling is applied by means of the fan at the base of the cooler. The high voltage windings are connected in star so that the transmission systems may be operated with an earthed neutral. The transformers are designed for operation in an area prone to severe lightning and to withstand the appropriate test pressures. The bushings are of the condenser type. Each 132 kV bushing is oil filled and carries a current transformer for protection purposes, and a capacity voltage tapping is also brought out. On-load tap changing equipment is provided on the h.v. side, affording a total of fifteen running positions to give a voltage variation of plus and minus 10 per cent in equal steps.

The eight transformers covered by the present contract will be installed in three groups, two of three transformers and one of two. It will be possible to arrange for one voltage relay to control all of the regulators in one bank, so that tap changes are made simultaneously. Should one of a group get out of synchronism with the remainder it will endeavour to re-synchronize itself with the master unit, and until it has done so the master unit will not be able to make a further change.

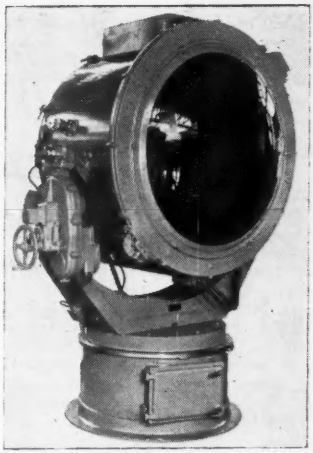
Oil and winding thermometers are housed in a weatherproof case mounted on the side of the transformer, whilst an adjacent marshalling kiosk houses tap-changer motor and fan motor contactors, paralleling relays and control switches, etc. Other fittings include Buchholz relay, silica gel breather, magnetic oil gauge and explosion vent. The weight of each equipment complete with regulator and cooler, including oil, is 75½ tons.

Large Searchlight

The first of three 120 cm searchlights for Vickers-Armstrongs, Ltd., Naval Construction Works, Barrow-in-Furness, has recently been completed at the works of London Electric Firm, Ltd., Croydon. The searchlight, which weighs about 2½ tons and stands nearly 9ft high, is electronically operated by means of remote power control equipment supplied by Vickers-Armstrongs, Ltd. This enables the searchlight to be laid automatically from the ship's fire control equipment either by means of radar or telescope.

A high intensity arc lamp taking 150 A is arranged for combined automatic and hand feed. When running automatically, both positive and negative carbons are fed forward and the positive carbon rotates, the feed being so arranged that although the carbons are consumed at different rates, the arc remains at the focal point of the mirror. A "blanking switch" ensures that the motor driven iris shutter will automatically close through certain degrees for training, so that there is no possibility of the vessel being illuminated by its own searchlight.

Both training and elevating movements are motor driven, the motors running at 6,000 r.p.m. and one of them being provided with a cooling fan. Altogether there are ten electric motors or generators on the searchlight and in its base are housed 26 sliprings and brushes to convey power of various voltages and currents to different parts of the searchlight while the searchlight itself is moving. Stops are provided to prevent over-run of the elevating and depressing movements of the searchlight, the motors and gearing being so arranged that the searchlight can be driven at full power on to the stops without any adverse effect on the mechanism.



This 120 cm searchlight built by the London Electric Firm, Ltd., weighs 2½ tons and is nearly 9ft high

Works Visits

Wild-Barfield Electric Furnaces, Ltd., is again extending an invitation to senior students of technical colleges and like institutions to visit its works during the coming winter season from October to May. The tours include an inspection of the Research and Development Departments as well as the production side and take place during the afternoon of any work day (Monday to Friday).

Vancouver Television Station

The Canadian Broadcasting Corporation has selected Vancouver on the West Coast as the site for its fourth television station, and has ordered complete transmitter, studio and mobile broadcasting equipment from Marconi's Wireless Telegraph Co., Ltd., through the Canadian Marconi Co. Vancouver is to have a 5 kW vision transmitter, a 3 kW sound transmitter, with combining unit and ancillary equipment. These will be shipped to Canada this month, and the station will be in commission by the end of this year. The mobile outside broad-

casting unit is due for delivery towards the end of the year in time for the station's opening, but work on the studios will not begin until a later date, probably early in the new year. The system will operate on the North American standard of 525 lines, 60 c/s.

Bowthorpe Acquisition

Bowthorpe Holdings, Ltd., has acquired a controlling interest in Line Equipment, Ltd., manufacturers of high-voltage outdoor switchgear and fuses. The directors of Line Equipment are Mr. R. E. Cranston and Mr. P. H. Jackson (joint managing directors), Mr. D. S. Edwards, who is also the secretary of the company, Mr. R. A. Parsons and Mr. J. Bowthorpe. There will be no change in the management of the company, which will retain its offices at Bridgend, Glamorgan, South Wales, and 32, Queen Victoria Street, London, E.C.4.

Tungsten Ore Prices Reduced

The Ministry of Materials announces that from 1st August its selling prices for tungsten ores of standard 65 per cent grade and ordinary quality have been reduced as follows:—Wolframite from 335s to 327s 6d and Scheelite from 325s to 312s 6d per long ton unit delivered consumers' works. The new selling prices are based on the current London market prices.

Annual Holidays

The works of Milne & Longbottom, Ltd., are closing this evening (Friday) and will re-open on 24th August.

Hailwood & Ackroyd, Ltd., are closing their Beacon Works from to-day (Friday) until 24th August.

Works Visit

Members of the Western Centre, West Wales (Swansea) Sub-Centre, of the Institution of Electrical Engineers, visited the works of Permali, Ltd., for their summer outing on 4th July. A large party toured the company's Gloucester and Cheltenham works and saw all stages in the manufacture of "Permali" laminated insulation and "Dialam" tubes and high voltage bushings.

Switchgear Publication

A publication which deals with outdoor oil circuit breakers built by Brush Export, Ltd., Loughborough, with special reference to the American and Canadian market, has been issued by the company. It quotes ratings in accordance with American NEMA standards to meet American and Canadian requirements. The outdoor oil circuit breaker, type O.R.38, described in the booklet, covers breaking capacities of 1,000 MVA at 34·5 kV, 500 MVA at 23 kV, 500 MVA at 34·5 kV, 500 MVA at 46 kV. This type of circuit breaker is available for reasonable delivery periods in the American and Canadian markets.

Trade Announcements

The directors of **E. Dawson (Lamp Factors), Ltd.,** and **E. Dawson (Branches), Ltd.,** have negotiated a division of interests whereby Mr. W. Taylor, lately a director, and now associated with the Whitworth Electric Lamp Co., Ltd., 6-12, Gorleston Street, London, W.14, arranged for that company to take over the staff, leases, stock, etc., at 111, The Brook, Chatham, and 16a, London Road, Reigate. The change operates from 1st August and the business of E. Dawson (Branches), Ltd., is now being conducted from the office of the parent company, E. Dawson (Lamp Factors), Ltd., 10, Gray's Inn Road, London, W.C.1, where all accounts will be payable and from which address trading will continue.

Monks & Crane, Ltd., Birmingham, have opened a branch office at 79, Crown Street, Glasgow, C.5 (telephone : South 2907). Mr. A. McCabe, the new area manager for Scotland, will be operating from the Glasgow office.

S. D. Sullam, Ltd., is moving on 1st September to Africa House, Kingsway, London, W.C.2 (telephone : Chancery 8081).

M. K. Electric, Ltd., has appointed Mr. A. L. Phillips as its representative for the South West of England and South Wales.

New premises have been opened by the **Simplex Electric Co., Ltd.,** at Fire Brigade Buildings, London Road, Manchester, 1 (telephone : Central 9031). The new premises will provide increased storage space and a showroom.

The Ealing branch of **Superlamp, Ltd.,** has moved to 45, Boston Road, Hanwell, London, W.7. The telephone number is unchanged.

Catalogues and Lists

Radiovisor Parent, Ltd., 1, Stanhope Street, London, N.W.1.—Leaflet describing the company's new Mark XV automatic lighting control units.

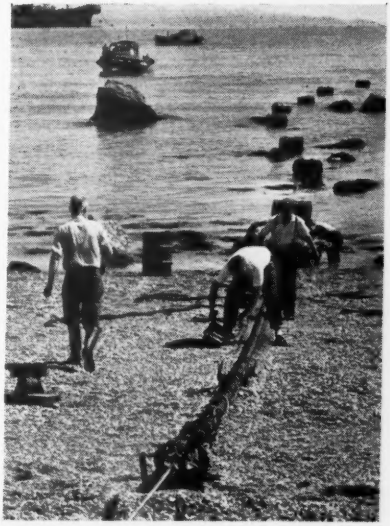
The Sheffield Twist Drill & Steel Co., Ltd., Summerfield Street, Sheffield, 11.—Illustrated folder announcing the "Blue Finish" for Dormer high speed steel twist drills.

Deco Engineering Co., Ltd., West Row North, Kensington, London, W.10.—Illustrated catalogue of "Deco" cable reeling drums and industrial electrical equipment including limit switches, centrifugal switches, trolley wire collector systems, etc.

Hedin, Ltd., Commerce Estate, South Woodford, London, E.18.—Illustrated leaflet on industrial electric ovens.

England-France Power Link

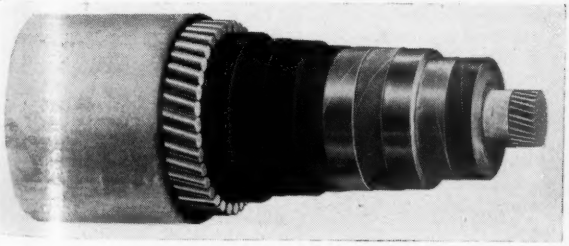
Submarine Cable Trials at Dover

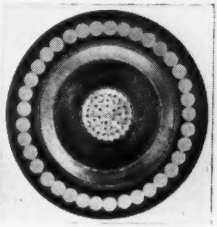


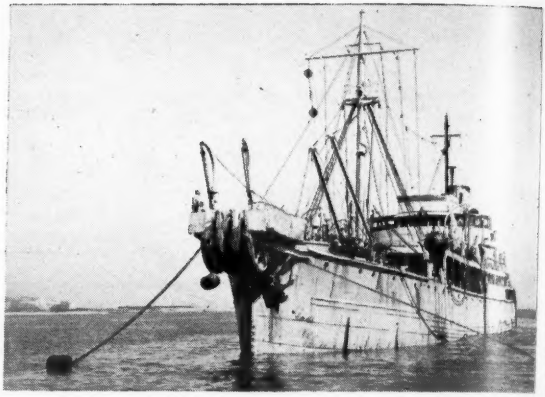
GENERAL particulars of the sea trials of means of interconnecting the high voltage transmission systems of the British Electricity Authority and Electricité de France were given in the *Electrical Review* of 3rd July. A start was made with the work on 25th July, when a test length of 132 kV cable was paid out from the Post Office cable-laying ship *Alert*, half a mile out at sea, and floated ashore near Dover, where it was pulled by winch to a shelf on Shakespeare Cliff, on which is assembled the testing equipment, and secured to an anchoring stub.

The difficulties of such operations are illustrated by the necessity of suspending the programme owing to unfavourable weather over the week-end which compelled the vessel's return to the harbour before

In the top illustration the 132 kV, 0·5 sq in gas-filled submarine cable is shown being floated ashore and in the second photograph the end of the cable is seen as it reached the shore. The construction of the cable is illustrated below







The cable being paid out from H.M.T.S. *Alert*

the second half-mile of cable in parallel could be laid. Both lengths are of the pre-impregnated gas-filled type made by W. T. Glover & Co., Ltd. This design in its land form has been in commercial service in this country for many years and details of its construction were given in a paper presented by Beaver and Davy in February, 1944, before the Institution of Electrical Engineers.

The cables for the Dover trials have a 0·5 sq in copper conductor, paper insulated and protected by a lead alloy sheath and aluminium alloy wire armour with jute sewing in one case and hessian in the other. Each includes at its mid point a flexible joint of the same diameter as the cable; the two will be joined at sea by a rigid joint. A third cable, 250 yards long, to Glover's design but made in France by the Tréfileries et Laminoirs du Havre, awaits its turn in the *Alert* to be joined to the common end of the others by a second rigid joint and terminated at its sea end in an anchored stop-end joint.

From the testing site the cable will be maintained under a gas pressure of 250 lb/sq in and an electrical pressure of 300,000 V d.c. On conclusion of these preliminary trials the cables and joints are to be recovered for thorough examination. It is hoped that the results will provide sufficient information for the two Authorities to decide upon the feasibility of a cross-channel connection entailing the laying of about 25 miles of cable, which may be in one length.

In its technical aspects the experimental work is the fruit of co-operation between W. T. Glover & Co., Ltd., and British Insulated Callender's Cables, Ltd., which with the B.I.C. Construction Co., Ltd., form a Project Group under the chairmanship of Mr. D. T. Hollingsworth (chief engineer, B.I.C.) with Mr. E. L. Davey (W. T. Glover & Co.) as chief executive engineer. The Project Group is acting in close collaboration with the B.E.A. under the personal direction of Mr. D. P. Sayers, deputy chief engineer (transmission) of the Authority.

Contact Phenomena

IN spite of the importance of contact phenomena it is only during the last ten years that the fundamental processes involved have received quantitative and detailed study. A survey of the existing knowledge of the physical processes occurring at contacts has just been published at 3s (75 cents U.S.A.) by H.M. Stationery Office for the D.S.I.R. as Radio Research Special Report No. 24. With the title "Fundamental Processes of Contact Phenomena," it is intended to provide those making or designing contact equipment with the practical and theoretical information which is now available on the subject.

The report gives detailed consideration to the factors involved in contact failure arising from mechanical distortion of the contacting faces or from a reduction in their electrical conductivity. It also discusses the possibility of the development of a suitable contact material for long reliable operating life and indicates those topics on which further research is required in order that technical problems may be solved.

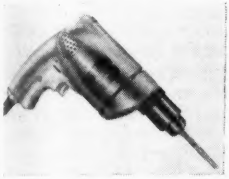
Although extensive literature exists on contact problems there is still no general agreement about the theoretical processes involved. The range of uses of contacts, from heavy-duty power switching to electrostatic contact making, and the diversity of operating conditions has resulted in the concentration of research on particular problems rather than on general theory. The report considers the problem in its simplest form and seeks to provide a comprehensive picture of the fundamental processes involved.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Heavy-Duty Drill

THE ½in heavy-duty "Holgun" drill made by BLACK & DECKER, LTD., Harmondsworth, Middlesex, has an improved pistol grip and a motor 25 per cent more powerful than the previous standard model. It weighs only 3¼ lb. Two models are available, one having a no-load spindle speed of 1,700 r.p.m. and the other a speed of 600 r.p.m. The reduced spindle speed and increased torque of the low speed model make it suitable for production work in Monel metal and other modern hard alloys.



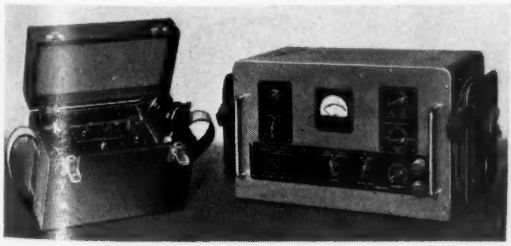
Black & Decker "Holgun" drill

Cable Fault Finder

The cable fault finder made by the ADDISON ELECTRIC CO., Ltd., 10/12, Bosworth Road, London, W.10, has been considerably improved.

This instrument, which also serves to trace pipe lines, identify wires and measure the depth of cables and pipes, has been reduced in size and weight; its dimensions are 12in by 9in by 6in, and its weight about 10 lb. Two detector coils are provided, one of which is built into the lower part of the carrying case. The other is incorporated in the lid, which is provided with "slide-out" hinges so that the coil can be removed from the case. Holding it by its carrying handle, the operator may use it to trace accurately the path of concealed cables and pipe lines in buildings, etc. An improved wave filter has been incorporated to eliminate interference from neighbouring power cables, and the instrument is self-contained, combining in a single carrying case a high-gain amplifier, the two detector coils and a pair of headphones. A feature of the instrument is a patented direct-reading depth measuring circuit.

The oscillator shown to the right of the illustration provides 200 and 1,000 c/s signals, continuous or interrupted, at an adjustable output impedance and with a maximum output power of 25 W. It may be operated both from a 12 V accumulator or from the a.c. mains. The front panel controls comprise a cable current meter, a rotary mains tapping selector switch, frequency changing controls and an output matching control.



Addison Electric improved cable fault finder

Boiling Pan

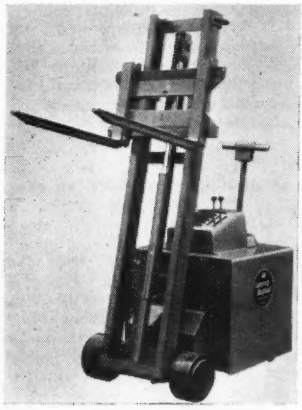
A series of stainless steel boiling pans produced by EUK CATERING MACHINERY, LTD., Wellington Street, Oldham, incorporates steam generation as a means of applying heat to the pan. A seamless welded stainless steel pan with integral hob incorporating a vapour sealing water lute is supported in a heavily galvanized jacket. A sump fitted to the base of the jacket is connected to a heavy duty galvanized supply tank complete with ball control feed valve, sight glass and steam pressure equalizer. A

Euk boiling pan

specially designed coil type battery of immersion heaters is bolted into the sump in such a manner as to be easily withdrawn for service and is connected to a stainless steel control box, thermostatic control being available if desired. A steam safety valve is fitted. Fibre glass insulation is utilized throughout. The standard sizes are 10, 20, 30 and 50 gal, which are loaded respectively at 7·5 kW, 10·5 kW, 15 kW and 21 kW.

Fork Lift Truck

The latest addition to the range of fork lift trucks made by LANSING-BAGNALL, LTD., Basingstoke, Hants, is the Type PF 100 electrically operated model. With a weight of less than one ton it has a capacity of 1,000 lb at 15in centres from the heel of the fork. It is pedestrian controlled and particularly designed for use in confined spaces. The driving controls are all in the handle head and comprise a twist grip speed control, giving infinitely variable speeds from 0 to 4 m.p.h., and a preselective reversing switch. The lift and tilt controls for the forks are also within easy reach and so is the immobilizing key switch.



Lansing-Bagnall pedestrian controlled fork lift truck

Black-base Cooking Utensils

By permanently darkening the bottoms of their "Pyramid" ground base cooking utensils HAGUE & MCKENZIE, LTD., Pyramid Works, Sloane Street, Birmingham, 1, claim to effect a considerable improvement in efficiency. Typical figures show that to boil 5 pints of water from 62 deg F on a 1,600 W radiant type plate takes 14·16 min with a black-base pan compared with 15·30 min with an untreated pan. A similar comparison using a 1,800 W solid plate gives 13·5 min and 17·5 min respectively.

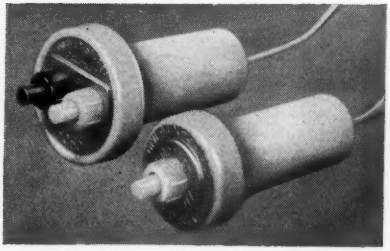
Pear Switch Dimmers

Two pear switch dimmers of German manufacture are available, under the trade name "Divilux," from WALTER LOGAN & CO., LTD., 26, Downing Court, Brunswick Square, London, W.C.1. One is for dimming a 25 W lamp by a fixed amount and the other a 40 W lamp, both being suitable for operation in circuits of up to 250 V a.c. These dimmers operate by placing a capacitance in series with the lamp so that when they are in circuit there is a saving in consumption. In one model a single switch is incorporated and the unit is wired in parallel with the switch controlling the lamp. The other model incorporates two switches, one for dimming and the other for controlling the lamp.

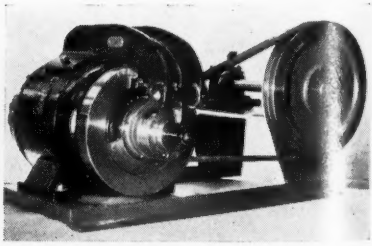
Clutch Motors

An improved range of "Mardrive" clutch motors (Type D.I.) is now available from the Marine Engineering Co. (Stockport), Ltd., Bulkeley Street, Stockport. They can be arranged for control by Bowden cable, direct mechanical linkage or remote control by solenoid operation. The motor can be d.c. or a.c. single- or three-phase 40–60 c/s 110–550 V to suit customers' requirements.

"Divilux" pear switch dimmers



Mardrive Type D.I. clutch motor



Progress in Radiography

International Exhibition of Equipment in Copenhagen

By B. M. WHEATLEY, Ph.D., A.Inst.P.

THE recent international exhibition of equipment for the diagnosis, investigation and treatment of disease by radiation (Copenhagen, 20th to 24th July) was opened in the presence of the Danish Minister of Trade and contained much of interest to electrical engineers. The 55,000 sq ft of the Forum was filled with apparatus from eleven countries and the exhibition was attended by 20,000 visitors.

Medical equipment presents some curious problems to the designer since, although the market is highly competitive, there is rarely sufficient demand for any particular item to warrant mass production methods. Instead, the equipment is sold on the basis of its quality and reliability. The days when intricate apparatus was a novelty have long since passed, and it is now essential for manufacturers to understand the purpose of the equipment so well that they can make a positive contribution to medicine by designing suitable apparatus. As a result, the most successful firms are those with a vigorous research and development policy. Such a policy is of course expensive, but the reward is that the finished apparatus is more useful and hence more easily sold. The Continental firms, particularly the German ones, seem fully aware of this. In common with most others, the medical equipment industry is developing a new post-war outlook and there has been considerable progress in design since the last international exhibition in London three years ago (*Electrical Review*, 4th August, 1950).

New X-ray Tube Design

We will consider the diagnostic and therapeutic uses of X-rays and radiation from radioactive material separately. In diagnosis the radiation must be detected after its passage through the body, and the problem is to get a bright image with good contrast without unduly irradiating the patient or the operator. For some purposes films may be used as detectors and they have the advantage that they can be examined after the exposure. Progress in this type of radiography was shown in the design of new X-ray tubes which can momentarily convert amperes of current to X-rays. The heat dissipation of the targets of these tubes has been improved so that the heavy loads do not involve increasing the size of the focal spot. Such high intensity apparatus is invaluable for taking cine-radiographs of moving organs.

Often fluorescent screens are used as detectors, but have the disadvantage that the brightness of the image is so low that the observer must wait until his eyes are dark-adapted before appreciating the detail in the image. However, several image amplifiers were shown in which the picture is electronically intensified so that the tedious period of adaptation can be reduced and less radiation is required.

Prevention of Blurring

These advances in the production and detection of diagnostic radiation may well revolutionize our present practices. The recent work on radiography with tube voltages in the 150 kV region has led to the production of high voltage diagnostic equipment which is useful for examining detail in thick body sections. Apart from tube design there is the problem of preventing scattered radiation from blurring the image. Some beautifully made grids were exhibited which use the principle of the Potter-Bucky grid to block the scatter. Often it is convenient to confine the examination to a particular region of the anatomy by moving the tube and the detector simultaneously so that the only stationary image is from the body section containing the centre of movement. Such apparatus involves movements of large masses with a fine degree of co-ordination. The mechanical and electrical problems have been elegantly solved by many firms.

The use of radioactive materials in the diagnosis of disease is still growing.

Although the electrical engineer plays a big part in the production of the isotopes, he is behind the scenes controlling the cyclotrons and nuclear reactors rather than producing hospital equipment. It is in the detection of radiation from the isotopes that the electrical engineer is foremost. Apart from the use of isotopes for radiography, they can be administered internally to become localized in a particular organ (such as iodine in the thyroid) or they can be used to trace out the course of material through the body (as in blood flow measurements with sodium salts). In such cases the detector must possess unusual sensitivity. Geiger counters are often sufficiently sensitive and new types with halogen quenching and having a remarkably long life were exhibited. Even more sensitive were the scintillation counters which are more easily collimated for investigations needing high resolution. The electronic apparatus associated with counting techniques showed many minor improvements. Probably the most important of these were the production of corona stabilizers for e.h.v. supplies and the use of dekatron valves in the scaling circuits.

Therapy Section

In the therapy section it was clear that since 1950 the attitude has changed from " how best can we use this equipment " to " what apparatus will do what we want." This seemed particularly true of apparatus for deep therapy, since it appears that betatrons and other accelerators are so expensive that comparatively few centres can afford them. A complete betatron was shown and several models of linear accelerators also attracted attention, but for many people the cost of such installations was prohibitive. Fortunately the engineers have produced alternatives for treating deep-seated lesions.

The obvious way of concentrating radiation at a depth is to move the beam over the surface of the patient so that the beam is always directed at the tumour, whereas the skin dose is spread out over a large area. One can move either the focus of the X-ray tube or the patient, but in either case there is the difficulty of electrical control. In one apparatus the focal spot moved along a circular path, whereas in several others the entire X-ray tube was mounted on an arm which moved over the patient. One or two sets were arranged so that a mechanical linkage could be added to move a conventional 250 kV therapy tube in an arc over the body. The most severe electrical problems occur when the patient and the X-ray tube are moved together in order to trace a prescribed path. It is in such application that the servo engineer is required to synchronize the movement and to provide feedback so that the X-ray output remains constant throughout the treatment.

For superficial therapy at low kV progress has been mainly in X-ray tube design and beryllium windows are now a commonplace. The tubes themselves can be made to fit body cavities.

One interesting development since 1950 is that several firms are now making small but massive units containing the equivalent of several kg of Ra in the form of an artificially radioactive isotope, usually cobalt-60. Such units give a beam with many of the properties of high energy accelerators but with no maintenance difficulties. These units are mounted for either single or moving field therapy. The electrical engineer has also contributed appreciably to the use of isotopes for internal therapy by designing remote handling equipment and electronic counters of extreme sensitivity and robustness. For the routine examination of excreta samples an elegant automatic apparatus was demonstrated in which a printed record is made of the activity of each of 24 samples taken in turn.

The overall impression of the exhibition was that the medical equipment industry is showing a healthy expansion and that the efforts of the design engineers are of such quality that a definite improvement in medical technique is available.

Batti-Wallahs' Society

THE work done by U.N.R.R.A. in combating disease, particularly typhus, in Europe during the years immediately following the last war is a side of that organization which has received little publicity. At last week's luncheon of the Batti-Wallahs' Society, Dr. Andrew Topping, M.D., Dean of the London School of Hygiene and Tropical Medicine, who as Director of Health (European Division), U.N.R.R.A., did much to organize medical relief in Europe, gave an interesting account of the work done and some of the obstacles which had to be overcome.

The next luncheon will be on 30th September, the speaker being Mr. Ted Leather, M.P.

Large Biscuit Oven

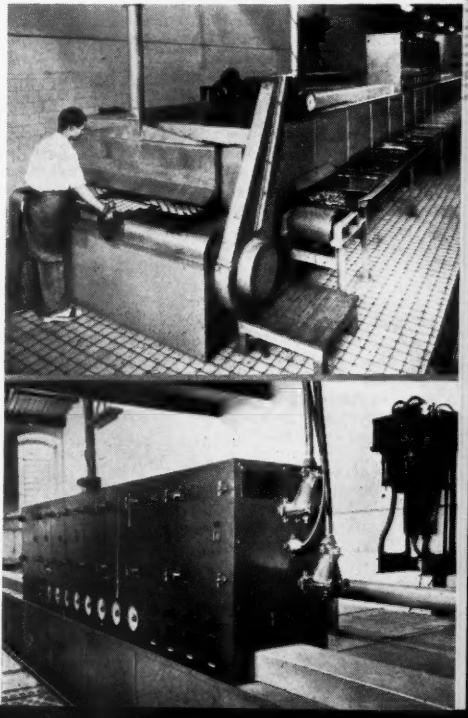
G.E.C. 275 kW Equipment Installed in Brazil

A BISCUIT oven which is believed to be the largest in Brazil has recently been put into service at the works of Francia & Cia, Ltda., Rio de Janeiro. Made by the General Electric Co., Ltd., the three-tray 275 kW travelling biscuit oven is 7ft wide and 48ft long and during an eight-hour working day bakes five tons of cream crackers and water biscuits. It was erected on site by Francia & Cia, Ltda., under the supervision of Drake Do Brasil S.A., agents for the G.E.C. in Brazil.

The oven has eight separately controlled banks of heating elements extending right across the oven and arranged four above and four below the conveyor. These elements, of coiled Nichrome wire supported in porcelain cleats carried on a bar, are easily removable from the side of the oven. To minimize heat losses during maintenance the busbars have been arranged in a chamber on the outside of the oven's inner casing so that to remove an element it is only necessary to remove a cover plate and a portion of lagging behind it. Each bank of elements has a mercury-in-steel indication controller with a rigid bulb extending into the oven, together with a suitable relay, pilot lamp and control push-button switch which works in conjunction with the relay so that any or all of the heated sections can be cut out if required independently of the main oil circuit breaker.

Controllers are fitted on the side of the oven near the centres of the sections they control and the rest of the control equipment is mounted on a central panel above the oven. The indicator of each controller is set for the temperature required and as soon as the temperature tends to rise above this point the control circuit is broken, the current to that particular section being switched off by an air-break contactor. When the temperature falls the current is automatically switched on again. There are eight green pilot lamps indicating the operation of the contactors controlling the eight separately heated sections and a red pilot light to show when the main switch is closed. The contactors, with a series of handguard fuses for each section, are mounted in steel plate cubicles carried above the control panel.

A separate triple-pole main oil circuit breaker, with a rupturing capacity of 15 MVA at 400 V, is fitted with overload protection, a neutral link, and auxiliary switch, no volt coil and a 6in dial moving-iron ammeter and voltmeter. The no-volt coil and the auxiliary switch are connected in series with the interlock switches on each of the contactor cubicle doors, so that access to the contactor cubicle is impossible without the main oil circuit



Biscuits, prior to cooking, being loaded on the three-tray, 275 kW, 48ft long G.E.C. travelling biscuit oven at the works of Francia & Cia, Ltda., Rio de Janeiro. The lower photograph is a general view of the control panel showing indicating lamps, contactor panels and temperature controllers. The main o.c.b. can be seen on the wall to the right

breaker being thrown out and isolating the whole installation from the mains. The main and neutral lines from the oil circuit breaker feed direct to the busbars in the contactor cubicle. The contactor cubicle also houses the control gear for the 2 h.p. drive motor and all of the fuses on the installation, with the exception of two in the oil circuit breaker.

The oven body is of double case construction. The inner case is slung from the outer framework by means of suspension bolts (a method for which the G.E.C. holds the patent) so that there is a minimum of through metal and radiation losses are consequently kept as low as possible. A space of 9/12in between the inner and outer casings is packed with mineral wool to prevent heat loss. To counteract the varying expansion of the inner and outer casings expansion joints are arranged at intervals.

The conveyor runs straight through the oven and returns underneath and outside it. It consists of six heavy link roller chains of the Renold pattern with "camel back" sides which support the three 2ft wide trays in the width of the oven. The whole weight of the conveyor and charge is taken on channel irons, in which the chains run, and these are supported at frequent intervals, the load eventually being transferred to rolled steel channels supporting the oven casing.

The driving gear for the conveyor comprises a 2 h.p., totally enclosed, squirrel cage, induction motor, driving through variable reduction gears arranged at the biscuit discharge end of the oven, the final drive to the main conveyor chain shaft being by chains and wheels. The range of baking times obtainable through the variable reduction gear is arranged as required by Francia & Cia, Ltda., within the limits of 3½–20 min. Drop down doors are provided at each end of the oven.

Alkali Inspectors' Report

THE problem of dust emission from cement works in England and Wales is referred to in the report for the year 1952 of the Chief Alkali Inspector of the Ministry of Housing and Local Government and the Chief Inspector for Scotland (H.M. Stationery Office, 2s 6d). Failure of electrical precipitators used for the de-dusting of kiln gases has been a matter for grave concern. Most of the trouble has been of mechanical origin due chiefly to the corrosion of parts within the precipitator by the moist waste gases.

Electrical failure seems to be comparatively rare, but has sometimes occurred as a result of a burn-out of h.v. cables. Most so-called electrical failures were primarily the consequence of a mechanical breakdown. The report goes on to deal with several failures in detail and says that there have been discussions with the industry as to the means to be taken to reduce to the minimum condensation and the consequent corrosion and all the troubles that are thereby entailed.

Visits were made during the year to seven generating stations. Some were in course of construction and the opportunity was taken to examine critically the means to be provided for the de-dusting of waste gases. At others which were already in operation, improved installations were noted and the results of grit arrestment efficiency tests were discussed.

Progress in dealing with low level dust emissions from grinding, bagging and so forth in the cement industry continues at a reasonably satisfactory rate. The next few years should see all works, even the small, remote works against which there is no complaint, equipped to deal with this problem. Considerable attention continues to be paid to Thames-side, where about half the cement in the country is produced. The Ministry is in close touch with the local authorities, and it had been hoped that this report would be able to record further progress. The failure of a number of precipitators has, however, led to deterioration of a temporary nature, fortunately offset to some extent by improvements resulting from progressive reduction of emissions at low level. Complaint from the Medway region has been much less than in 1951. The report adds that the experience of the factors militating against continued steady operation of electrical precipitators should result in better operation of the rebuilt units and prevent more recently erected units going the way of the others. In the meantime dust emission from the affected kilns is being kept as low as possible by careful attention to the chain systems.

I.E.C. in Yugoslavia

Delegates from Seventeen Countries Attend Meetings

By a Special Correspondent

WHEN the Council of the International Electrotechnical Commission received, last September, an invitation from the Yugoslavia Electrotechnical Committee for the 1953 grouped series of meetings to be held in that country, the British delegation withdrew their provisional invitation for the 1953 meetings to be held in England and the Yugoslav invitation was accepted. At that time many delegates thought that difficulties might be encountered in securing a good attendance at meetings in Yugoslavia but, in actual fact, the attendance at the meetings which were held at Opatija from 22nd June to 1st July was almost a post-war record. About 300 delegates from seventeen countries participated, and the largest delegation was that from the United Kingdom, which was represented by 42 delegates appointed by the British National Committee (under the ægis of the British Standards Institution).

The I.E.C. is affiliated to, and forms the Electrical Division of, the International Organization for Standardization (I.S.O.), but it retains its autonomy as regards policy, procedure and finance. Full liaison is maintained between the two organizations, and the president (Mr. H. Tornebohm, Sweden) and the general secretary (Mr. St. Leger) of the I.S.O. attended the meetings by special invitation.

To everybody's deep regret, Mr. C. le Maistre, general secretary of the I.E.C., was prevented through illness from attending the meeting, this being the first occasion on which he had missed an important I.E.C. meeting since the formation of the Commission in 1904. At the opening meeting on 22nd June, the president of the I.E.C. (Dr. H. Osborne, U.S.A.) paid a tribute to the work done by Mr. le Maistre during the past 49 years, but little did anyone realize at that time that Mr. le Maistre was to pass away so soon. As has already been reported, he died on 5th July.

Opatija is a seaside resort a few miles from Rijeka (formerly known by its Italian name Fiume) and the various Committee meetings were held in three of the largest of the numerous hotels in that delightful spot. Meetings of fifteen Technical Committees and Sub-Committees were held, together with a meeting of the Committee of Action.

COMMITTEE OF ACTION

The Committee of Action, which acts as an Executive Committee on behalf of the Council, met under the chairmanship of Dr. Osborne (president of the I.E.C.) on 1st July and, in addition to receiving reports from the various Technical Committees, dealt with a number of matters of policy and procedure. Arrangements for carrying on the work of the I.E.C. were discussed. The administrative secretary (Mr. L. Ruppert), whose work in preparation for the Opatija meetings during the past few months was universally acclaimed, will be assisted by the president (Dr. Osborne, U.S.A.), Dr. P. Dunsheath (treasurer) and the immediate past-president (Dr. Schiesser, Switzerland), who has agreed to act as deputy-president.

The Committee of Action also decided to inaugurate a Charles le Maistre Lecture, to be given by some distinguished man invited by the Council each year to deliver an address on some general aspect of international standardization at the annual group of I.E.C. meetings. An appeal is to be launched in order to raise the necessary funds to put this tribute to the late Mr. le Maistre on a sound footing.

In presenting the budget for the year 1953–54, the treasurer (Dr. Dunsheath) drew attention to the increasing amount of work falling upon the central office which, coupled with rising costs, made it imperative either to curtail the activities of the I.E.C. or to take steps to increase the annual income. The Committee of Action

agreed that a curtailment of activity would be most undesirable and that, with a view to increasing the income of the central office, the National Committees should be requested to contribute on a slightly higher basis than hitherto.

It was also agreed that some of the larger countries should be invited to contribute special sums towards a working capital fund if they had not already done so. In this connection it may be noted that the United Kingdom, together with three other countries, made such a contribution a few years ago.

The budget for 1953–54 was approved at a basic figure of about 240,000 Swiss francs as against 180,000 Swiss francs for the previous year.

Arrangements for the jubilee celebrations to be held in Philadelphia in September, 1954, were discussed. It was agreed that as many as possible of the Technical Committees should hold meetings at that time, and that one day should be devoted to a special celebration of the fiftieth anniversary of the I.E.C.

Looking farther ahead, the Committee of Action accepted an invitation from the U.K. delegation for the grouped meetings in 1955 to be held in England. Note was also taken of a provisional invitation from the German delegation for the 1956 grouped meetings to be held in the German Federal Republic. The possibility of holding a meeting in India at some future date was also discussed.

Electrotechnical Vocabulary

Among other matters discussed by the Committee of Action was the question of financial assistance from the Union of International Engineering Organizations, out of U.N.E.S.C.O. funds, towards the printing of the second edition of the International Electrotechnical Vocabulary. It will take some time for the whole of the vocabulary to be revised, but the offer of financial assistance from U.N.E.S.C.O. is dependent on the draft of certain sections of the vocabulary being completed by 30th November this year. Special efforts are therefore to be made to complete these sections by the date stipulated.

A report was also submitted by the general secretary of I.S.O. regarding the activities of that body in fields which are of interest also to the I.E.C. It is gratifying to be able to report that full liaison between I.E.C. and I.S.O. Technical Committees has been established in all appropriate cases.

WORK OF TECHNICAL COMMITTEES

The following notes outline the work accomplished by the Technical Committees and Sub-Committees:—

Graphical Symbols.—The I.E.C. lists of graphical symbols for heavy current and light current engineering are under revision, and it is hoped to be able to produce a single list of symbols which will be acceptable to all branches of the electrical industry. This is a long-term project, however, and as a first step a short list of basic symbols has been drawn up. The question of a classification scheme for diagrams for connections is also under discussion.

Telecommunications. — Recommendations regarding the method of making measurements on broadcast television receivers were discussed. Agreement was reached on a specification dealing with fixed paper capacitors and on a colour code for ceramic capacitors, and these two documents will be circulated to the National Committees for approval. A sub-committee on high-frequency cables and connectors was set up, and it was decided to undertake the study of piezo-electric crystals with a view to the preparation of a specification.

A specification dealing with the basic climatic and mechanical robustness testing procedure for radio components has been under discussion for some years, this document being largely based on a British specification. At the meeting at Opatija a number of comments on the document were dealt with and a final version of the specification will now be printed and published. It was considered that this document is of basic importance and that it should therefore be brought to the attention of other Technical Committees, as the test methods prescribed may be of use for products other than electronic components.

Insulating Materials.—Under this heading consideration is being given to the methods of testing materials for specific properties, and at the meeting attention was concentrated on tests for tracking, volume resistivity, surface resistivity and heat resistance. For the last two or three years this work has been done by a small

sub-committee of experts, but it is now proposed that the programme of work shall be reviewed with the object of expediting what must inevitably be a long programme.

Switchgear and Control Gear.—The I.E.C. specification for circuit breakers is under revision and Chapter 1, Rules for Short-Circuit Conditions, has been completed and approved for publication. Chapter 2, Rules for Normal Load Conditions, was discussed at Opatija and a new draft will now be prepared for circulation to the National Committees for approval. The same stage has also been reached regarding a supplement to Chapter 1 dealing with the unit testing of circuit breakers for making capacity and breaking capacity.

A new committee to deal with low-voltage switchgear has been formed, and the work of this committee is expected to be of major importance as it will deal with such things as the electrical equipment on machine tools.

Electric Cables.—There has for some years been an I.E.C. specification for the testing of paper-insulated cables for voltages of 10 kV up to 66 kV. This has now been revised and a new draft will be circulated to the National Committees for approval. Preliminary consideration was also given to a specification of low-pressure oil-filled cables, a report by a Committee of the Paris High Tension Conference (C.I.G.R.E.) being taken as a basis.

Power Converting Equipment.—A specification for mercury arc rectifiers has been under discussion for some years and it has now been agreed that, although the draft is still incomplete in certain respects, it can be circulated to the National Committees for approval. An editing Committee has been set up and charged with the duty of preparing a final text. Work will now be started on a specification for dry type rectifier equipment.

Lamps and Related Equipment.—Three Sub-Committees dealing with lamps, lamp caps and auxiliaries, respectively, have been very active during the last few years, the secretariat for these subjects being the B.S.I. Good progress towards the completion of several specifications was made at Opatija. For instance, a specification for tubular fluorescent lamps and another one dealing with ballasts for fluorescent lamps have now reached the stage where final drafts can be circulated to the National Committees for approval. There have been prolonged discussions on the subject of the colours of fluorescent lamps and close liaison is being maintained with a Committee of the International Commission on Illumination, which is also studying certain aspects of the same problem.

A discussion took place regarding the economic life of tungsten filament lamps, the Swedish Committee having asked that an investigation should be carried out to determine whether the rated life of 1,000 hours, which was decided upon many years ago, still represented the optimum life from an economic point of view. In the course of the discussion stress was laid on the difficulty of assessing some of the factors affecting the economic life of a lamp and the difficulty of fixing a single value for the life which would represent the most economic life in all countries. The outcome of the discussion was that the Swedish National Committee will give further thought to the problem and decide whether any action on an international basis seems likely to lead to useful results. It has been decided that in the meantime action shall be taken to provide data which will enable those countries who so desire to draw up their own specification for tungsten filament lamps having a life of the order of 2,500 hours. As far as is known only four countries, namely Norway, Denmark, Netherlands and Switzerland, are interested in lamps having a life of this order, all other countries being satisfied with a rated life of 1,000 hours.

Another subject which has given rise to lengthy discussions during recent years is that of the safety aspect of Edison screw lampholders. Some countries require that a lamp shall be " safe " (i.e., it must not be possible to touch any live parts of the cap or holder) not only when the lamp is fully home in its holder but also during insertion or withdrawal of the lamp. This requirement has raised many difficulties, however, in the design of holders, due to the fact that caps of three different lengths are still in use. It is now generally agreed that it is impossible to ensure that all the lamps at present in use will fit all existing " safety " holders and the the I.E.C. must concentrate its attention on ensuring that lamps and holders made in the future will be interchangeable and safe when the lamps are fully inserted. Proposals to achieve this will now be worked out for

circulation to the National Committees for consideration. These proposals are based on the assumption that the E 27/25 cap will be brought into general use in all countries as rapidly as possible.

A sub-committee has been set up to deal with lighting fittings, but work on this subject will not be commenced until a draft specification can be submitted by the International Commission on Rules for the Approval for Electrical Equipment (C.E.E.). The latter organization is actively considering a specification for fittings for tungsten filament lamps and close liaison will be established between the C.E.E. and I.E.C.

Lightning Arrestors.—A committee of experts gave detailed consideration to a draft specification for lightning arrestors of the type incorporating non-linear resistors. Considerable progress was made with the sections dealing with definitions, ratings and methods of test. Provisional agreement was reached on some of the test values, but further consideration must be given to values of residual voltage.

Electronic Valves.—The first meeting of a new Technical Committee on Electronic Tubes and Valves was held. Work on this subject was previously done by a sub-committee of the Technical Committee on Radio Equipment, but in view of the importance of the subject it was decided that valves should be dealt with by an independent committee. There was some discussion on whether the title of the committee should refer to "tubes" or "valves," the former term being preferred by the Americans and the latter by the United Kingdom. As was perhaps to be expected, the only acceptable solution was to adopt the title Electronic Tubes and Valves.

After many years' work a specification for electronic valves and their bases has been completed. Attention is now being given to the dimensions of sub-miniature valves and a draft specification will be prepared by the secretariat (Netherlands) for circulation to the National Committees.

Acoustics.—There was some discussion regarding the respective scopes of the I.E.C. Committee on Electric-Acoustics and the I.S.O. Committee on Acoustics. A draft resolution was drawn up for submission to both the I.E.C. and the I.S.O. to the effect that the two committees should in future meet concurrently: that for the present the I.E.C. should be responsible for all electro-acoustical standards matters, including sound recording and reproducing apparatus, acoustical measurements and terminology; and that the I.S.O. should at present deal only with musical pitch, and any addition to this programme should be subject to agreement between the Committee of Action of the I.E.C. and the Council of the I.S.O. This resolution was adopted by the Committee of Action and was later adopted also by the Council of the I.S.O.

Electric and Magnetic Magnitudes and Units.—A draft resolution on the rationalization of the M.K.S. system of units was discussed and adopted for circulation to the National Committees for approval. At the same time it was agreed to invite the International Union of Pure and Applied Physics to hold a joint meeting with the I.E.C. Committee on Magnitudes and Units to discuss the way in which the decision regarding rationalization can best be implemented.

SOCIAL EVENTS

The Yugoslav Electrotechnical Committee, with the support of the Yugoslav Government and the local authorities, spared no effort to make the visit of the I.E.C. to Opatija a memorable one. In addition to numerous receptions, concerts and ballet performances organized in honour of the I.E.C., there was an interesting tour of inspection of the Nikola Tesla hydro-electric scheme, including a visit to the underground power station at Tribalj. A visit was also paid to the extensive caves at Postojna where the lighting installation gave rise to favourable comment both from the artistic and engineering point of view.

The delegates attending these meetings constituted the largest group of foreigners to visit Yugoslavia since the war, but in spite of lack of experience in dealing with a party of this size the organization of the social events and the arrangements for the technical meetings were excellent.

The president of the I.E.C., Dr. H. S. Osbourne, had the honour to be invited to visit Marshal Tito at his summer residence at Brione. The Marshal showed himself to be very well informed regarding the work of the I.E.C. and he expressed his appreciation of the objectives underlying these activities.

ELECTRICITY SUPPLY

Recent B.E.A. Contracts

Overhead Line Inquiry

CONTRACTS have been placed by the British Electricity Authority during the past month for power stations, transforming stations and transmission lines costing in the aggregate £10,290,453. The principal contracts include the following:—

Acton Lane "B" power station, Willesden: Two 240,000 lb/hr boilers.—Mitchell Engineering, Ltd.

Marchwood power station, near Southampton: Structural steelwork.—Alex Findlay & Co. One 550,000 lb/hr boiler.—John Thompson Water Tube Boilers.

East Yelland power station, near Barnstaple: Two 30 MW turbo-generators and feed heating plants.—C. A. Parsons & Co.

Tilbury power station: Three 60 MW turbo-generators, condensing and feed heating plants.—C. A. Parsons & Co. Piling for foundations for second half of station.—Holloway Bros. (London).

Castle Donington power station, near Derby: 275 kV switchgear.—British Thomson-Houston Co.

Nottingham power station: Two 300,000 lb/hr boilers and ancillary equipment.—Mitchell Engineering.

Wakefield power station, Yorks: High pressure steam feed pipework and valves.—Aiton & Co.

Stella North power station, near Newcastle-upon-Tyne: Two 60 MW turbo-generators, condensing and feed heating plants.—C. A. Parsons & Co.

Huncoat power station, Accrington: One cooling tower.—Film Cooling Towers (1925). Foundations for turbo-generator set and boiler.—J. Jarvis & Sons.

Barony power station, Ayr: Preliminary civil engineering works.—John Laing & Sons.

Clyde's Mill power station, Glasgow: Pipework, valves, steam receivers and tanks.—Stewarts & Lloyds.

Hartley substation, Kent: 132 kV isolators and connections.—English Electric Co.

Harrow substation, Middlesex: 90 MVA 132/33 kV transformers.—English Electric Co.

Woolwich–Eltham, London: 132 kV, 22 kV and auxiliary cables.—W. T. Glover & Co.

Andover, Hants–Thatcham, Berks: 132 kV double circuit line.—Pirelli-General Cable Works.

Lancaster–Quernmore and Blackburn–Quernmore: 132 kV overhead line.—British Insulated Callender's Construction Co.

Cambuslang–Clyde's Mill: 132 kV cables.—Pirelli-General Cable Works.

I.O.W. *Inquiry*

An inquiry was held at Shanklin, I.O.W., recently into a proposal by the Southern Electricity Board to erect an overhead line from a substation at Green Lane, Shanklin, to connect with an overhead line north of Sandown. Underground cable would be used in places where the line was thought to be too near buildings or injurious to amenities. For the County Council and the Sandown–Shanklin U.D.C. it was contended that the scheme would be detrimental to the area. It was also asserted that the Board was not honouring an agreement made before the industry was nationalized in which an undertaking was given not to erect overhead lines without the consent of the local authorities, such consent not to be unreasonably withheld. On behalf of the Board, Mr. D. G. J. Millington said that the supply system was operating under a new charter which nullified the agreement. The very point of the inquiry, however, was that the Board considered that consent was being unreasonably withheld.

Cooker and Wash-boiler Tender

At a meeting of Hetton (Durham) U.D.C., the surveyor (Mr. P. W. Richardson) reported that a firm whose tender had been accepted for the supply of electric cookers and wash-boilers had withdrawn its tender "because of pressure from other firms under the fair trade agreement clause." The Council decided to send a vigorous protest on the subject to the Urban District Councils' Association, Mr. C. F. Grey, the local M.P., and the northern group of M.P.s.

Kafue Power Scheme

Representatives of the Governments of Southern and Northern Rhodesia met at Lusaka last week to begin discussions on the Kafue Gorge hydro-electric scheme. The Northern Rhodesian Government is anxious to proceed with the Kafue development rather than wait for the larger project at Kariba.

Cost of Farm Supplies

Northumberland Farmers' Union has advised its members not to enter into agreements at present with the North Eastern Electricity Board for the supply of electricity to farms owing to the high capital charges imposed.

Israel Power Station Extension

The new 50,000 kW hydrogen-cooled turbo-generator installed at the extension of the Reading power station in Tel-Aviv, Israel, went into operation recently after final tests.

Electrical Installations

Stamford Town Council has approved in principle a scheme for wiring all 1919 and 1924 type council houses still without electricity.

STOCKS and SHARES

QUIET but distinctly firm conditions continue to prevail in most sections of the Stock Exchange. Apart from the activity in the English Electric new issues, the main topic for discussion in the market for electrical engineering shares has been the report accompanying the G.E.C. annual accounts. Points singled out for reflection were the references to the fall in sales of consumer goods, which appears now, however, to have been arrested; and to the record output of capital equipment, in which department the outlook since the end of the year in March has tended, says the report, to become less favourable. G.E.C. shares leaned to the dull side at a little under 40s. There were improvements of 1s or more in A.E.I., Parsons and Westinghouse shares.

Chloride Electrical Storage

Another advance in the price of Chloride Electrical Storage £1 ordinary in the week before the holiday left these shares with a net gain of as much as 7s 6d on the month, which they ended at 78s 6d. The shares were temporarily unsettled earlier this year on the occasion of the annual results, which produced an increase in the distribution from 15 to 20 per cent, but a reduction of half a million in the net profits, this being ascribed largely to the effects of the fall in lead prices. The distribution remained well within earnings, and the balance-sheet formidably strong in reserves and cash.

Pye Dividend

Market expectations of an increase in the Pye company's earnings and dividend were well satisfied with the declaration of a payment of 20 per cent on the deferred shares for the year ended last March, and with the preliminary announcement of a 22 per cent expansion of the trading profit. The price of the 5s deferred shares remained firm at 17s 9d. The rate of dividend is 2 per cent more than last year's; payable, moreover, on capital since increased by a small share bonus, and by an issue of shares for cash. On the basis of the latest dividend, the yield on the shares goes up to 5·6 per cent.

New Issues

Animated business continues in the English Electric new 4½ per cent debenture stock 1972–77. The premium has hardened to 3½ points on the issue price of 97½, bringing the all-in price to 101. It is at present £50 paid, with the balance of £47½ due 26th August, until which date the stock will be transferable free of stamp. The same company's new ordinary shares retained a premium of about 4s 4½d on the offered price of 48s 6d. Calls are due to be paid of 20s on 14th August and of 28s 6d on 18th September.

Dubilier Condenser Results

Allowing for a 40 per cent capital bonus, the 25 per cent dividend declared by the Dubilier Condenser Company represents an increase of 5 per cent on last year's payment, which amounted to 28 per cent on the smaller number of the shares then ranking. This is the third time in succession upon which the company has been able to raise the distribution, without departing from a decidedly conservative policy. Dividends for the latest period cost under £30,000 net from a profit of £113,000 after tax provisions: these include a figure of £53,000 for the Excess Profits Levy alone, and leave the year's surplus lower than before, despite a record trading profit. With the price of the 1s ordinary shares little changed at 3s 6d, the yield works out at nearly 7 per cent.

Stock on Offer

Among the shares recently on offer in reasonably large numbers have been Dictograph Telephone 2s ordinary at a fraction under 5s 6d. The yield is 7 guineas per cent, assuming the maintenance of the dividend at last year's rate of 20 per cent after the one-for-four share bonus. Oldham & Son 1s shares have been available at 2s 9d, and Telephone Manufacturing 5s shares at 9s, the indicated yields being respectively a little under and over 6½ per cent.

E.P.L.

With the Excess Profits Levy due to expire at the end of this year, practical interest attaches to a recently-compiled market estimate of the extent to which many individual companies have been affected. Telegraph Condenser appears in these estimates as one of the principal victims of the Levy, the amount paid on that account being given as the equivalent of 31 per cent on the ordinary capital, as compared with the dividend of 20 per cent paid. Other estimates (at an annual rate) include Ward & Goldstone, paying the equivalent of 27 per cent on account of E.P.L. (dividend paid 45 per cent); Scottish Cables 9 (20) per cent; Laurence Scott 13 (15) per cent; and London Electric Wire 7 (15) per cent.

REPORTS and DIVIDENDS

The Revo Electric Co., Ltd., held its annual meeting on 29th July, Mr. W. L. Barrows (chairman) presiding. In his circulated statement, the chairman said that the accounts for the past year compared not unfavourably with those of the previous year in spite of the difficult trading conditions which were experienced in certain sections of the business, particularly in the domestic appliance field and the foundries. Consent of the Treasury had been obtained to the issue of 1,470,000 ordinary shares of 10s each by way of capitalization of reserves and undistributed profits. To give effect to this it was proposed to increase the capital to £1,250,000 by the creation of 1,500,000 additional ordinary shares of 10s each, and to issue 1,470,000 new ordinary shares in the proportion of two shares for every one held.

At a subsequent extraordinary meeting the increase of capital and bonus issue proposals were sanctioned.

Hick, Hargreaves & Co., Ltd., held their annual meeting on 29th July. Mr. W. D'Arcy Madden (chairman and managing director), who presided, said that the works had been in full production throughout the year under review and the turnover was increased by over 20 per cent on the previous year. The contracts on their books exceeded £5 million sterling and included condensing plant and feed heating contracts for the British Electricity Authority for commissioning up to the end of 1958. It was hoped to have the new erecting shop in production before the end of 1954.

E. K. Cole, Ltd.—Speaking at the annual meeting held on 28th July, Mr. E. K. Cole (chairman and managing director) said that the radio division established a new record in turnover during the year under review. The electronics division continued to expand and the production of radar, communications, and nucleonic equipment for the Government services and commercial use increased. A new company, Ekco Electronics, Ltd., had been formed to handle this section of the business. Trading conditions in the plastics division were difficult, but improvement occurred during the first three months of the current year and was still maintained. Restrictions and high rate of purchase tax imposed on the products of the heating division continued during the year. A slight easement of the position had recently taken place, and this, together with the fact that they were launching redesigned space heaters would, they anticipated, lead to an increase in turnover. Continued progress was made in the marine field. A new record turnover had been achieved with overseas countries, but it was becoming increasingly difficult to maintain their export position due to restrictions by overseas Governments, coupled with keen competition from foreign manufacturers.

Pye, Ltd., in a preliminary statement, reports group profits for 1952-53 of £743,973, an increase of £132,934, as compared with the preceding year, and after deducting taxation of £508,256, there is a balance of £235,717 (against £162,219). It is proposed to pay a dividend for the year of 20 per cent on the deferred ordinary, as increased by a scrip issue of 1 in 18 and a "rights" issue of £144,687 in December last. This compares with 18 per cent on the former capital.

The Dubilier Condenser Co. (1925), Ltd.—The accounts for the year ended 31st March last show a trading profit of £419,639 as compared with £411,212 for the preceding year, and after providing £241,393 for taxation, the net profit is £113,009 (against £130,285). It is proposed to pay an ordinary dividend for the year of 25 per cent on capital increased by a 40 per cent scrip issue, and to carry forward £119,633 (against £85,830 brought in). For the previous year the dividend on the smaller capital was 28 per cent.

Telephone Properties, Ltd., reports a net profit for 1952, after meeting all charges, including £64,000 for taxation, of £60,964, as compared with £48,919 for 1951. It is proposed to pay a dividend for the year on the ordinary stock of 8 per cent (same), and to carry forward £74,967 (against £44,203 brought in).

Hoover, Ltd., has declared an interim dividend of 10 per cent tax free (unchanged).

The Cables Investment Trust, Ltd., is paying a final dividend of 5 per cent, maintaining the distribution for the year at 8 per cent.

New Companies

Hamilton Installations, Ltd.—Registered 18th July. Capital £1,000. Electrical engineers and contractors, etc. Directors: J. H. Dubbery, L. B. Dubbery and G. W. Bussell. Regd. office: 33, King Street, E.C.2.

C. R. Irving & Co., Ltd.—Registered 20th July. Capital £100. Electrical and mechanical engineers, etc. Directors: C. R. Irving and Myra O. D. Irving. Regd. office: 67, Chase Side, Southgate, N.14.

K. L. Television Services, Ltd.—Registered 17th July. Capital £100. Manufacturers

of and dealers in electrical and mechanical apparatus and accessories, etc. Directors: B. Kutner, H. Kaye and D. Lawrie. Regd. office: 9, Golden Square, W.1.

Technical Ceramics, Ltd.—Registered 23rd July. Capital £100. Manufacturers, buyers, sellers, suppliers, importers, exporters and dealers in ceramics, technical porcelain, electrical insulating material, etc. Subscribers: L. J. Huggett and J. J. Spreyer. Solicitors: Godfrey Warr & Co., 19, Fenchurch Street, E.C.3.

Liquidations

Ranelagh Radio & Electrical Co., Ltd.—Meetings of members and creditors on 9th September at the offices of A. E. Attwood & Co., 20-21, Lawrence Lane, Cheapside, London, E.C.2, to receive an account of the winding-up by the liquidator, Mr. A. E. Attwood.

Seal Radio & Television Service, Ltd.—Winding up voluntarily. Liquidator, Mr. P. W. Hort, 28, Baldwin Street, Bristol, appointed 9th July.

Bankruptcies

J. W. Luker and **H. A. R. Phillip**, lately carrying on business in partnership at East Street, Lewes, Sussex, and at 206, High Street, Lewes, under the style of Gordon & Luker, electrical contractors.—First meeting held 5th August. Public examination 16th October at the Court House, Church Street, Brighton.

J. Bannister, electrical contractor, carrying on business at 2, The Wiend, Wigan, Lancs.—Trustee, Mr. A. T. Eaves, 47, Mosley Street, Manchester, 2, released 17th July, 1953.

H. W. Sharp, carrying on business at 178, Osmaston Road, Derby, as "Willdays," electrical and radio engineer.—Last day for receiving proofs for dividend 17th August. Trustee, Mr. A. W. Hunter, Latham & Co., Walter House, 418-422, Strand, London, W.C.2.

F. L. Napier, 5, School Road, Sale, Ches, electrical contractor.—Last day for receiving proofs for dividend 19th August. Trustee, Mr. G. H. Eaves, 47, Mosley Street, Manchester, 2.

Trade with China

IT is announced that a group of British businessmen who have been to Peking for trade discussions with the Chinese commercial authorities have entered into a business arrangement with the China National Import and Export Corporation providing for an exchange of commodities to a minimum total value of £15 million in each direction. The exports from Great Britain will include metal and metal products, machinery, electrical materials and equipment, tools and instruments, communication and transportation equipment. The arrangement covers a period of one year until 30th June, 1954, and can be extended by the agreement of both sides.

The individual businessmen participating in the visit have signed nearly ninety contracts for exports from the United Kingdom to a value of about £7 million, covering the products of some fifty British concerns. Some of these are firm contracts for which export licences have already been granted; the remainder are provisional upon the granting of the requisite export licences by the British Board of Trade. Among the exports from the United Kingdom covered by these contracts are scientific instruments, electric cables, generators, electric motors, switchgear, and fluorescent lamps. This visit, which was intended to be mainly exploratory, provided the first opportunity for any group of British businessmen to discuss practical questions of trade at first hand with the Chinese commercial authorities. The members of the group obtained a clearer idea of China's likely requirements in the next year or two and an understanding of those products which are not likely to find a market in China for some years to come. The group represented a total of some 150 British manufacturers and included two representatives of the British Council for the Promotion of International Trade. Among its members were Mr. M. D. H. Burn (Tube Investments, Ltd.), Mr. S. G. Holmes (Enfield Cables, Ltd., Brynmawr Rubber Co., Ltd., and Enfield Rolling Mills, Ltd.), Mr. S. A. Lane (Brush Aboe group of companies), and Mr. H. H. Spencer (Crompton Parkinson, Ltd.).

Mr. Lei Jen-Min, Vice-Minister of Foreign Trade, who received the visitors on 13th July, stressed the value to both countries of increased trade between Britain and China and underlined the normal conditions needed to develop it. He explained that China was just entering the first year of her Five Year Economic Plan. In the fulfilment of this plan they needed a substantial volume of machinery and engineering products as well as raw materials, and the major emphasis would be on heavy industry. After three or four years, when the first economic difficulties had been overcome and the living standards of the Chinese had been improved, they would require many consumer goods

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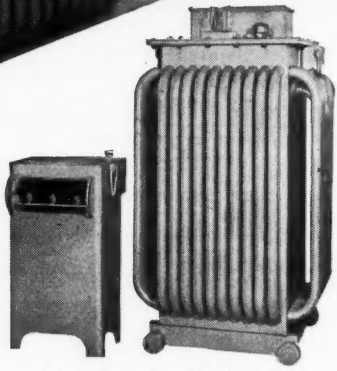

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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 16th September from the Patent Office, 25, Southampton Buildings, London, W.C.2

1949

6860. Stinton, G. M., Stinton, E. C. A., and Stinton, J. W.—Portable electric switching apparatus. 13th June, 1950. (697002.)

20191. Compagnie des Freins & Signaux Westinghouse.—Multi-electrode crystal device for producing electronic relay action. 3rd August, 1949. (697164.)

22654. Electric & Musical Industries, Ltd.—Magnetic sound recording and reproducing apparatus. 1st September, 1950. (697165.)

33160. Graber, H.—Fluorescent discharge lamp. 28th December, 1949. (697087.)

1950

3133. Compagnie des Freins & Signaux Westinghouse.—High-frequency oscillation generators. 7th February, 1950. (697168.)

7660. Marconi's Wireless Telegraph Co., Ltd.—Radar systems. 6th February, 1951. (697090.)

8537. Lucas, Ltd., J.—Means for regulating a.c. generators. 29th May, 1951. (697170.)

11470. Electric & Musical Industries, Ltd.—Circuit arrangements embodying electronic tubes. 9th May, 1951. (697092.)

15341. Electric & Musical Industries, Ltd.—Containers adapted to enclose electrical apparatus. 29th May, 1951. (697012.)

17170. Arlux.—Fluorescent discharge tube safety lamps. 10th July, 1950. (697096.)

20248. British Thomson-Houston Co., Ltd.—Firing oil-fired equipment. 15th August, 1950. (697101.)

23286. British Thomson-Houston Co., Ltd., and Moir, J.—Potentiometers and circuit arrangements used in connection therewith. 16th August, 1951. (697180.)

25189. Associated Electrical Industries, Ltd.—High-voltage electrostatic apparatus for accelerating charged particles. 3rd August, 1951. (697105.)

26582. Barth, G.—Electric circuits for measuring resistances, voltages or currents. 31st October, 1950. (697025.)

30754. Brighi, S.—Braking and locking means for electric motors. 18th December, 1950. (697112.)

1951

2956. Soc. d'Electro-Chimie, d'Electrometallurgie et des Acieries Electriques d'Ugine.—Magneto-striction oscillators. 6th February, 1951. (697030.)

4313. Pierce Foundation, J. B.—Electric switches, particularly electromagnetic switches. 22nd February, 1951. (697184.)

5345. M-O Valve Co., Ltd., and Widdowson, A. E.—Manufacture of electric discharge devices. 29th February, 1952. (697032.)

5421. British Electrical & Allied Industries Research Association.—D.c. electric transmission systems employing valve convertors. 28th February, 1952. (697305.)

6159. General Electric Co., Ltd., James, E. G., and Lindell, A. O. E.—Apparatus for measuring capacitances having an associated shunt conductance. 26th November, 1951. (697247.)

8009. Fielden (Electronics), Ltd.—Electrical proximity switches. 4th April, 1952. Addition to 645732. (697253.)

8179. Philips Electrical Industries, Ltd.—Cathode-ray tubes. 5th April, 1951. (697188.)

8180. British Oxygen Co., Ltd.—Determination of the temperature of deposition of electrically non-conducting solids from gases. 8th April, 1952. (697254.)

8241. National Research Development Corporation.—Underground gasification of coal. 24th March, 1952. (697189.)

9632. Philips Electrical Industries, Ltd.—Multiple stable state electron-discharge tube circuits. 25th April, 1951. (697127.)

9788. Telefonaktiebolaget L. M. Ericsson.—Reflection-free antenna. 26th April, 1951. (697193.)

12764. Kooperativa Forbundet, Forening U.P.A.—Synchronous clock gear device. 30th May, 1951. (697047.)

12885. Svenska Aktiebolaget Gas-Accumulator.—Welding apparatus. 31st May, 1951. (697048.)

13579. Aktiebolaget Tudor.—Electrodes for galvanic cells. 7th June, 1951. (697198.)

14154. General Electric Co., Ltd., Brandreth, R. D., Garthwaite, F. N., and Wilson, E.—Electrical apparatus. 25th June, 1952. (697050.)

14215. Deutsche Edelstahlwerke Akt.-Ges.—Permanent magnets and a process for producing them. 15th June, 1951. (697051.)

14632. Philips Electrical Industries, Ltd.—Radiation counter tubes. 20th June, 1951. (697052.)

15079. Philips Electrical Industries, Ltd.—Portable loudspeaker case. 25th June, 1951. (697135.)

15894. Parsons & Marine Engineering Turbine Research & Development Association, and Terrell, B. J.—Gas-turbine installations. 18th March, 1952. (697137.)

16729. General Electric Co., Ltd., and Field, R. W. G.—Electrical systems of remote supervision. 25th April, 1952. (697140.)

21169. Standard Telephones & Cables, Ltd.—Dry contact type rectifiers. (697269.)

22398. Philips Electrical Industries, Ltd.—A.c. relays. 25th September, 1951. (697062.)

24365. Nederlandse Centrale Organisatie Voor Toegepast-Natuurwetenschappelijk Onderzoek.—Balanced low-frequency amplifiers. 18th October, 1951. (697064.)

24726. British Thomson-Houston Co., Ltd.—Injection moulding and extrusion apparatus. 23rd October, 1951. (697273.)

24913. Loewe Opta Akt.-Ges.—Sound recording and reproducing device. 25th October, 1951. (697146.)

24951. Philips Electrical Industries, Ltd.—Sawtooth oscillation generators. 25th October, 1951. (697147.)

25606. Gilbert, C. E.—Line cord switch. 1st November, 1951. (697065.)

26513. Tastes, M. de.—Electromagnetic attraction motors. 13th November, 1951. (697066.)

27197. Westinghouse Electric International Co.—High-frequency tuning devices. 20th November, 1951. (697068.)

27657. Hudson Manufacturing Co., H. D.—Electric immersion heater. 26th November, 1951. (697205.)

27690. Akt.-Ges. Brown, Boveri & Cie.—Diffuser arrangement for electrical machines with radial-flow fans. 26th November, 1951. (697206.)

29194. Standard Telephones & Cables, Ltd.—Method of applying a protective and electrically insulating covering to components. 13th December, 1951. (697275.)

29957. Erie Resistor Corporation.—Electric components comprising resistances and capacitances. 21st December, 1951. (697070.)

1952

4225. Standard Telephones & Cables, Ltd.—Electrical rectifying apparatus. 18th February, 1952. (697213.)

6641. Standard Telephones & Cables, Ltd. (Federal Telecommunication Laboratories, Inc.).—Circularly polarized antenna arrangement for radar. 14th March, 1952. (697152.)

8812. Allmanna Svenska Elektriska Aktiebolaget.—Arrangement in automatic electric arc-welding machines. 7th April, 1952. (697220.)

9315. Compagnie Industrielle des Telephones.—Method of and device for signalling in pulse communication system. 10th April, 1952. (697280.)

13404. Westinghouse Electric International Co.—Electric convertors embodying electron-discharge devices. 27th May, 1952. (697079.)

14312. Standard Telephones & Cables, Ltd.—Loading coils. 6th June, 1952. (697080.)

Amended Specification

686607. Garrett Corporation.—Electrical temperature regulating apparatus.

LIGHTING SCHEMES

A NEW sodium lighting scheme has recently been brought into use on the main Sheffield–Leeds trunk road. This is at WORSBOROUGH, near Barnsley. It comprises a total of 88 "Sieray" 140 W sodium lamps in "Golden Ray" Mk III totally enclosed lanterns mounted on Concrete Utilities "Avenue" 3D and 3DN columns. All the lamps, lanterns and control gear were supplied by Siemens Electric Lamps and Supplies, Ltd., who also supervised the erection.

Sodium street lighting has been installed by the South Western Electricity Board on the new approach road to Portishead Dock. The road replaces one which will be closed when Portishead Railway Station is moved to make room for the construction of the new Portishead "B" power station. B.T.H. horizontal sodium open lanterns housing 140 W "Mazda" lamps are mounted on 25ft reinforced concrete columns spaced at approximately 140ft intervals.

Sodium street lighting installation at Portishead Dock approach road

For the lighting of the trunk road through FRASERBURGH, together with the main shopping centre of Broad Street, 86 enclosed lanterns have been installed using 140 W Osram sodium lamps supplied by the General Electric Co., Ltd. In addition, 72 lighting positions in the side streets have been changed from 100 W tungsten to 60 W sodium lamps. Erection in Broad Street and the side streets was carried out by Donald's, Fraserburgh, and in the trunk road by Murray, Mackie, Ltd., of Peterhead.

TIPTON Corporation has been informed that a recommendation has been made to the Ministry of Housing and Local Government to issue a loan consent for £6,171 for the installation of Class "A" electric street lighting on Bridge Road, Horseley Road (part), Upper Church Lane and Lower Church Lane.

MORPETH Town Council has decided in favour of sodium discharge lamps for street lighting. The borough engineer (Mr. F. K. Perkins) said that most local authorities preferred this type of lighting as against mercury vapour, as the costs of electricity and routine maintenance were less.

TRANSPORT NOTES

Proposed Trolley-bus Route

BRADFORD Transport Committee has approved a scheme provisionally agreed with the Yorkshire Electricity Board in connection with the electrical equipment required for the conversion of the Whibsey motor-bus route to trolley-bus operation. It is proposed that the Corporation should pay the cost of switchgear and rectifying equipment, including d.c. metering equipment, and that the Board should pay the cost of buildings and mains and the depreciated value of existing cables in Little Horton Lane and between Valley Road and Morley Street. The apportionment of the total cost of the electrical equipment between the Corporation and the Board would be as follows: Yorkshire Electricity Board, £10,173; Bradford Corporation, £5,375.

WEST HARTLEPOOL.—During the past financial year the Corporation trolley bus service made a profit of £4,373 while the buses lost £1,710, making a net profit on the joint undertaking of £2,663.

SUNDERLAND.—The Corporation has applied for permission to replace trams with buses on the seafront and Circle routes. The changeover, subject to buses being available, will take place in November.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Belfast.—13th August. Electric lighting installation in St. Stephen's Church Hall, Brown Square.—Education Architect's Department, Education Offices, Academy Street.

Brazil.—PORTO ALEGRE.—3rd November. Comissao Estadual de Energia Eletrica. Mechanical and electrical equipment for the Jacui hydro-electric power station at Potreirinho do Salto. (E.S.B. 205/53. Ten/6823.)*

Buckinghamshire.—18th August. County Council. Firms wishing to be considered for inclusion on an approved list for the supply and/or fixing of materials, including electrical installations (Section No. 26), and electric lighting fittings (27), can obtain particulars from the county architect, County Offices, Aylesbury.

Sedgley.—22nd August. U.D.C. Street lighting equipment. (See this issue.)

South Africa.—DURBAN.—14th August. City Council. Supply of kVA demand meters. (E.S.B. 00009/53. Ten/6817.)* Electricity meters. (E.S.B. 00010/53. Ten/6818.)*

PRETORIA.—13th August. Union Tender and Supplies Board. Radio and electrical equipment for the South African Air Force. (E.S.B. 00034/53. Ten/6816.)*

20th August. Supply of electronic test equipment. (E.S.B. 00048/53. Ten/6824.)*

SALISBURY. — 2nd November. Municipal Council. Supply of l.v. switchgear and accessories. (E.S.B. 00084/53. Ten/6821.)*

Sunderland.—14th August. Town Council. Electrical installations in shops and flats being built on three Sunderland housing estates.—H. C. Bishop, borough architect, Grange House, Stockton Road.

Thailand.—BANGKOK.—24th August. Stores Office, Railway Organization. Supply of electric cables. (E.S.B. 402/53. Ten/6815.)*

Warwickshire.—Firms wishing to have their names placed on a list of approved contractors from whom the County Council will invite tenders for schemes costing over £1,250 for (a) heating, hot and cold water supplies, steam services, laundry and kitchen equipment and/or (b) electric light and power installations should apply to the county architect by 31st August. (See this issue.)

*Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobalds Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Alnwick.—R.D.C. Electrical installations in 14 houses at Craster.—Norman Young.

Bath.—City Council. Recommended. Electrical installation works at the Secondary Modern Boys' School, Rush Hill (£6,275).—Blackmore & Nation.

Bishop Auckland.—U.D.C. Public lighting at Coundon (£3,039).—Doves (Darlington), Ltd.

Coventry.—Education Committee. Electrical installation work at Caludon Castle Comprehensive Secondary School (£13,640).—Electrical Installations, Ltd. (revised tender).

Croydon.—South West Metropolitan Regional Hospital Board. Recommended. Re-wiring of Block B at the Mayday Hospital, Croydon (£5,109).—W. Steward & Co., Ltd.

Durham.—County Council. Electrical installations in schools:—Haswell County School (£1,580); Ushaw Moor County School (£779); Stainton Camp Temporary School (£585).—Doves (Darlington), Ltd.

London.—POPLAR.—Borough Council. Recommended. Electrical installations and fittings for 12 shops and 21 dwellings in Roman Road (£1,138).—D. C. Engineering Co., Ltd.

Longbenton (Northumberland).—U.D.C. Electrical installations in 180 houses at Burradon.—A. F. Jemison.

Windsor.—Corporation. Electrical installations in 50 houses at the Manor Farm site, Clewer Hill Road (£1,278).—F. E. Morris, Slough.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alderley Edge.—New hostel and alterations to Homes, Great Warford; architect, Manchester Regional Hospital Board, Cheetwood Road, Manchester, 8.

Ashton-under-Lyne. — Central garage, administrative accommodation, etc. (£46,750); borough surveyor, Municipal Buildings.

Aylesbury.—Children's home, Southcourt estate; Bucks county architect, County Offices, Aylesbury.

Birmingham.—Shops (14), with flats over, at Comberton Road (£68,888); C. Bryant & Son, Ltd., 65, Whitmore Road, Birmingham.

Blackrod (Lancs).—Houses (56), for U.D.C.; J. C. Prestwich & Sons, architects, Bradshawgate Chambers, Leigh, Lancs.

Bury.—Extensions at Irwell Forge; Joseph Webb & Sons, Ltd.

Coventry.—New hospital; D. A. Goldfinch, architect to Birmingham Regional Hospital Board, 25, Augustus Road, Birmingham.

Doncaster.—R.C. junior mixed and infants' school, Armthorpe (£20,000); borough architect.

Egham.—Development of estate for houses, etc., Knowle Grove, Virginia Water, for U.D.C.; surveyor, Fire Station Buildings, High Street.

Gainsborough.—Reinstatement and partial rebuilding of Town Hall; Fisher & Hollingsworth, architects, 23, Lowgate, Hull.

Gateshead.—Flats on site behind High Street; borough surveyor.

Gloucester.—With regard to the note in our 24th July issue (extensions at Coney Hill Hospital), we are informed that the electrical work for this project has already been put out to contract.

Ilford.—Milk depot, etc., Eastern Avenue; London Co-operative Society, Ltd.

Jarrow.—Sixty shops and maisonnettes (£58,448); borough engineer.

Kidderminster.—Coppice Infants' School; A. H. Guest, Ltd., Amblecote.

Leeds.—Hostel for aged at Middleton Park Avenue; city architect.

Liverpool.—Dwellings (871), Croxteth estate; Unit Construction Co., Ltd., Liverpool. Ten-storey block of flats at Sparrow Hall, Fazakerley; R. Costain & Sons (Liverpool), Ltd. Homes (83), Ascot and Latimer Street; H. Barton & Sons (Liverpool), Ltd.

London.—CITY.—Flats (340), Golden Lane; Chamberlin, Powell & Bon, architects, 15, Avenue Studios, Fulham Road, S.W.3.

SOUTHWARK.—Baths, Peggotty Place; borough surveyor, Town Hall, Walworth Road, S.E.17.

Louth.—Flats (18), Spring Side; Palmer Construction Co., Ltd.

Houses (40), Holton-le-Clay, Tetney and North Thoresby, for R.D.C.; William Saunders & Partners, architects, 24, Castle Gate, Newark-on-Trent.

Three sewage disposal works, three ejector stations, etc.; J. H. Haiste & Partners, 4, Queen Square, Leeds, 2.

Manchester.—New church of St. Aidans at Northern Moor; Reynolds & Scott, architects, 9, Albert Square, Manchester.

Mansfield.—X-ray department at Kings Mill Hospital; E. G. Phillips, Son & Norfolk, consulting electrical engineers, Nottingham.

Nantwich.—Modernization of Market Hall, including concealed lighting; U.D.C. surveyor.

New Aycliffe.—Houses (297); G. A. Goldstraw, Aycliffe Development Corporation, Darlington.

Newcastle-on-Tyne.—Bus station, Picton Terrace; Northern General Transport Co., Bensham, Gateshead.

Norton Radstock.—Dwellings (80), Westfield; U.D.C. surveyor.

Nottingham.—Aspley Park Drive Secondary School; Gee, Walker & Slater, Ltd., Uttoxeter Old Road, Derby.

Ogmore Vale.—Pithead baths, Penllwyngent Colliery; National Coal Board, Welfare Division, Mount Stuart Square, Cardiff.

Oldbury.—Secondary modern school, Brandhall estate; L. C. Lomas, architect, 14, Castle Street, Worcester.

Penybont.—Five shops and flats, Pyle; M. Matthews, architect, Coity Road, Bridgend.

Portsmouth.—Reconstruction of premises in Commercial Road; Lloyds Bank, Ltd., Lombard Street, London, E.C.3.

Prescot.—Erection of St. Luke's R.C. School; J. Yearsley & Sons, Ltd., Fenton Street, St. Helens.

Redruth.—Factory; Remploy, Ltd., 25, Buckingham Gate, S.W.1.

Romford.—Factory; Blue Gate Products, Ltd., 8, North Street, E.13.

Saltfleet (Lincs).—Pumping station to contain three electrically driven pumps, for Lincs River Board; clerk of the Board, 50, Wide Bargate, Boston, Lincs.

Scarborough.—Houses (250); H. V. Overfield, borough engineer.

Sedgefield.—Houses (198), Trimdon Colliery, Chilton Buildings and Trimdon Village; R.D.C. surveyor.

Sheffield.—Industrial buildings at Clement Street for John Young (Sheffield), Ltd.; J. Mansell Jenkinson & Son, architects, Norfolk Row, Sheffield.

Shepton Mallet. — Factory extensions; C. & J. Clark, Ltd., shoe manufacturers, Street.

Shoreham-by-Sea. — Houses (105), shops with flats over, garages and outbuildings, on the Hammy Lane estate; S. Roth, Tetley & Felce, architects to U.D.C., 60, West Street, Brighton.

Smethwick.—First section of scheme of extensions to the Council House; borough surveyor.

Stourport-on-Severn. — Houses (72), Walshes estate, for U.D.C.; Percy Cox, Ltd., builders, Quarry Bank, Staffs.

Sunderland.—Additions in Durham Road for Mayfair Products, Ltd.; G. T. Brown & Son, architects, 53, Fawcett Street.

Surbiton.—Factory, Roebuck Road; Express Tools, Ltd., 21, Berrylands Road.

Tadcaster.—Houses (40), Swillington estate; Anthony Steel & Owen, architects, 89, Albion Street, Leeds.

Tewkesbury.—Four shops with flats above, Priors Park estate; Pemberton & Bateman, architects, 21, Vine Street, Evesham.

West Ham.—Five shops and maisonnettes, Balaam Street, and 13 flats and maisonnettes, Disraeli Road; borough architect.

Wolverhampton. — Flats (66), Moseley Village, Willenhall Road; J. Brock Allen, town clerk, Town Hall.